HT, JUNE 18, 1936

FIRST AERO WEEKLY IN THE WORLD

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FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

434
XXIX

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FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

Editor C. M. POULSEN

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Editorial, Advertising and Publishing Offices: DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1

Telegrams: Truditur, Sedist, London. Telephone: Waterloo 3333 (50 lines).

HERTFORD ST., COVENTRY.	GUILDHALL BUILDINGS, NAVIGATION ST., BIRMINGHAM, 2.	260, DEANSGATE, MANCHESTER, 3.	26B, RENFIELD ST., GLASGOW C.2.
Telegrams: Autocar, Coventry. Telephone: Coventry 5210.	Telegrams: Autopress, Birmingham. Telephone: Midland 2971.	Telegrams: Iliffe, Manchester. Telephone: Blackfriars 4412.	Telegrams: Iliffe, Glasgow. Telephone: Central 4857.

SUBSCRIPTION RATES: Home and Canada: Year, £1 12 0. 6 months, 16s. 6d. 3 months, 8s. 6d.
Other Countries: Year, £1 15 0. 6 months, 17s. 6d. 3 months, 8s. 9d.

No. 1434. Vol XXIX. JUNE 18, 1936. Thursdays, Price 6d.

Our New Equipment

PERHAPS the most interesting feature of the R.A.F. Display at Hendon next Saturday week will be the showing of new types recently produced for the Service. Everyone is interested in the expansion programme of the Air Force, and everyone is, or ought to be, impressed by the repeated assurances in Lord Swinton's speeches that a strong British Air Force is the greatest possible guarantee of world peace. The word expansion literally means an improvement in numbers, but the policy implied by that word also includes the provision of better aircraft than the R.A.F. has ever had before.

The names of the actual types which are to be shown this year have not yet been published, but in all probability there will be several classes, such as fighters, heavy bombers and medium bombers. Perhaps there will be more than one type shown in each class. The public may wonder, and such wonder would be excusable, if all the types in any one class will be accepted by the Air Ministry—and if so, why? Provided that all medium bombers, for example, are to do the same sort of work, the public may well ask why the Air Ministry should not choose the best type and equip all the medium bomber squadrons with it. In the pre-expansion days (a term which includes the present moment) there has at times been more than one type in the same class served out to the squadrons. Among light bombers there have been Harts, Gordons and Wallaces, and the reasons have not always been obvious to the plain man. It is, however, unsound to argue from the pre-expansion days. Economy was the mother of many queer inventions. It was presumed that no emergency was imminent, and we could therefore afford to equip some squadrons with types which were out of date.

The expansion, however, means an emergency—not a prospect of war but a determination to make Britain too strong to be attacked. It then becomes a real question whether we can afford to use aeroplanes which, though good, are not the best. This question is very pointedly discussed by an anonymous writer in a recent issue of the *Royal Air Force Quarterly*. First, he argues that we should get the best returns for effort expended by abolishing the classes of heavy bomber and light bomber, and by concentrating on the class of medium bomber. Having discussed that point at length, he goes on to urge that the Air Ministry should adopt only one type and should set a number of firms to work on producing it in great quantities. To prevent the sub-contracting firms from losing their initiative, he would have the Air Ministry insist that they should maintain their design staffs, and should each year submit a design for a replacement type. He does not extend his argument to fighters, but he would also have a special class of night bomber, a single-seater designed for speed and load, but unencumbered with any defensive armament. He argues very sensibly that darkness does not protect a bomber from an efficient organisation of searchlights and fighters, and that once a bomber is caught in a beam its machine guns are useless against the assaults of the fighter. Its only hope lies in speed. Another very sound remark of this writer is that, however fast one may make the bombers, fighters can always be made which will out-perform them. It is also interesting to see this very thoughtful writer giving his opinion that area bombing (*i.e.*, attacking an area such as the London docks) and dive bombing are likely to prove the most effective. He evidently thinks very little of altitude bombing.

To return to the proposal to select only one type of medium bomber and to serve it out to all medium bomber squadrons, the writer may be admitted to have made out his case provided that the functions of all medium bomber squadrons are to be identical. But will this actually be the case? Whereas one type may be superior in speed, another may have a longer range and a greater load-carrying capacity. In war it might easily be desirable to use one of these types for a certain

objective, and the other type in different circumstances. Moreover, it is very desirable to test out all such theories in air exercises, and that can only be done when at least one squadron has been equipped with each type and has become familiar with all its characteristics. For that reason, if for no other, it is not unwise on the part of the Air Ministry to order more than one type in any one class.

The Czigany Band

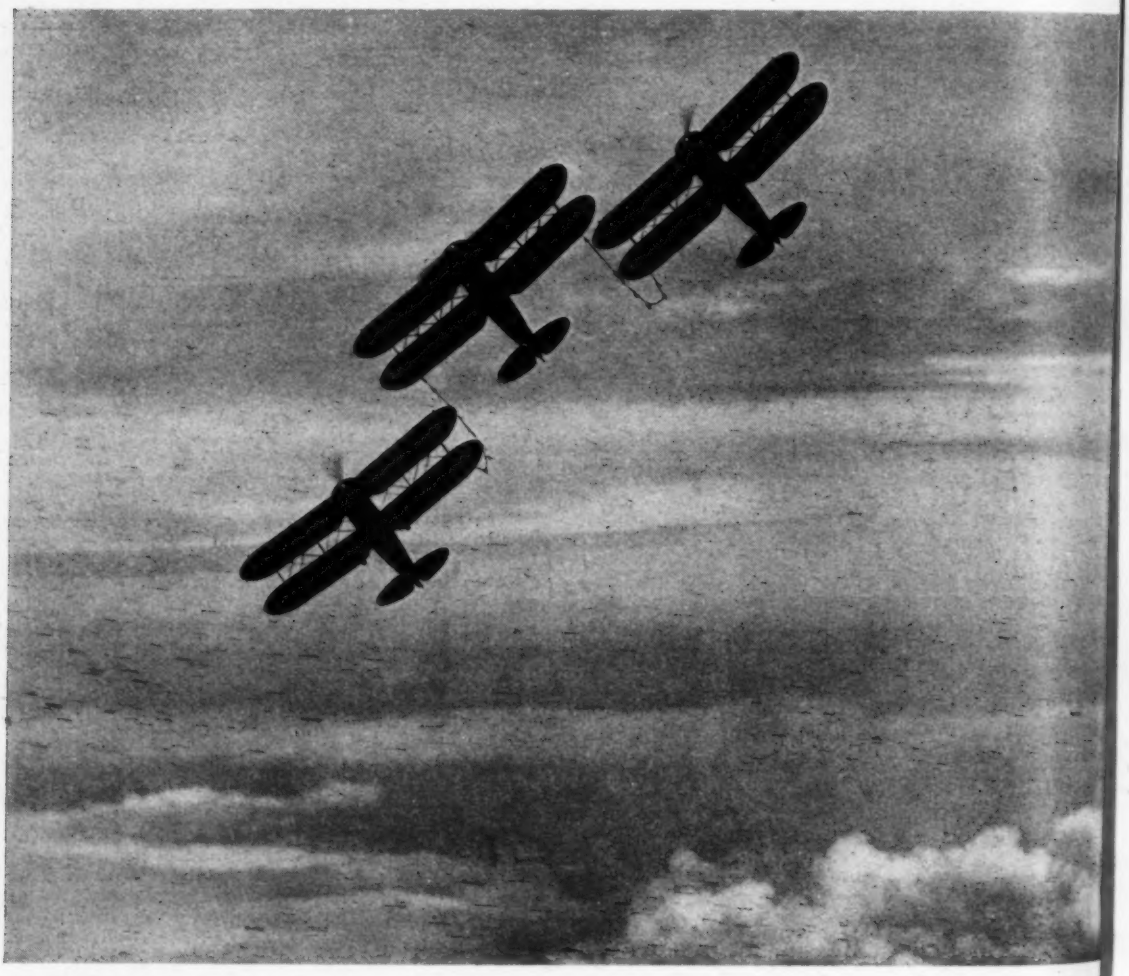
FOR the first time in history it is possible to announce in advance the engine which will win the King's Cup Air Race, to be flown on July 10-11 next. It will be a De Havilland Gipsy! We are not prepared to state just yet which aeroplane will win, because fifteen different types have been entered, whereas all the machines in the race have Gipsy engines.

An examination of the entries list published on page 652 discloses several interesting facts. The list is somewhat disappointing with a total of but twenty-eight machines. Last year there were thirty-six entries and twenty-nine starters. As the regulations are similar to those in force last year, with the exception of the introduction of a separate class for twin-engined aeroplanes, the relatively small number cannot be assumed to represent a protest against the rules.

Another interesting fact is that of the twenty-eight machines entered only one is a biplane. Of the types represented, the Vega Gull leads with five examples, followed by three each of the Hawk-Major and Hawk-Six. There are two of each of the following types: Gull, Sparrow Hawk, Falcon Six, Double Eagle, and Swift; the rest of the types are represented by single examples.

Of individual designers Miles leads the field with eleven machines; he is followed by Percival, who has eight machines in the race; British Aircraft and De Havillands come next with three each, Comper with two, and Henderson with one.

Many well-known pilots have been entered, but several previous winners of the race are absent from the entries list this year, among whom none will be missed more than Hubert Broad, who, if we are not mistaken, has flown in every one of the previous races.



CLOVER IN THE CLOUDS: The trefoil pattern made by the three Gloster Gauntlets of No. 19 (F.) Squadron as they make their almost literally breath-taking manœuvres in unison at the R.A.F. Display on June 27 will be watched by thousands. In this *Flight* photograph—the first aerial picture of this remarkable performance by the Gauntlets—we are shown the linked trio at close quarters. Other pictures will be found on pages 650 and 651. (*Flight* photograph).

The Outlook

A Running Commentary on Air Topics

The Future of Brooklands

SOME weeks ago we announced that Brooklands track and aerodrome was likely to change hands in the near future. Now comes the news that Electrical and General Industrial Trusts, Ltd., have purchased the estate from Dame Ethel Lock-King's syndicate, for a sum said to be in the neighbourhood of a quarter of a million pounds.

But the most interesting aspect of the change-over is the plans which the purchasers have made for the development of the property. The original suggestion that it would become a building estate is set aside. Instead, it is apparently the purchasers' intention to make Brooklands not only "the centre of modern motor sport and aviation," but also to develop it as an airport, served, like Gatwick, by a good railway.

They announce that the club amenities are to be improved—such luxuries as squash courts and a swimming pool are to be added—while sites for aircraft and other factories are to be prepared. All this is understandable, but what interests us is the airport proposal. Even though the plans include doing away with the famous—or notorious—sewage farm, the company appears to have set itself a Herculean task. Nobody can call the saucer-like aerodrome an ideal one from the take-off point of view, and even if the surrounding trees and the Members' Hill could be razed to the ground, there is still the banked track as a formidable wall round a large part of the perimeter. While the *status quo* does not greatly trouble the present club and military aircraft, one cannot imagine heavily loaded air liners being happy there.

Again, there are the almost annual winter flooding of the River Wey, and the Thames Valley fogs. Possibly the former difficulty could be overcome by modifying the course of the river and, perhaps, covering it over to increase the landing area.

Let it not be thought that we desire to pour cold water on the scheme; we are simply rendered a little breathless by its bold nature and anxiously await more concrete details of the plan of campaign.

De-Bouncing the Aeroplane

THE old story of Columbus and the egg finds a modern counterpart in Mr. L. E. Cowey and the B.L.G. landing gear described in this issue of *Flight*. It is rather necessary to bear in mind that the apparently obvious usefulness of this invention when applied to school machines may quite likely be the least important. Unless and until all aeroplanes are fitted with this type of undercarriage little is gained by making life a bit easier for the *ab initio* pilot if he has to undergo a course afterwards in landing on orthodox undercarriages.

Whatever may be the advantages of the new undercarriage in school work and on private aircraft, it will, we feel, be in other applications that the real value of the invention is found to lie. The subject of deck-landing aircraft comes to mind at once, and the three-wheeled undercarriage would seem to solve nearly all the aircraft carrier difficulties in one fell swoop. In fact, one might almost regard it as having been sent as a blessing for this particular purpose only.

In civil aviation it seems likely that the three-wheeled undercarriage will prove an extremely valuable contribution to the blind-landing problem. Aircraft can be guided to the immediate vicinity of the aerodrome by wireless, but the final touch-down still requires great skill. If the three-wheeled undercarriage should be found capable of an actual glide-landing following the wirelessly guided approach, obviously a very great step will have been taken, and safe landings in conditions of no visibility may be shorn of most of their terrors. What that may come to mean in the way of regular all-weather operation is not difficult to visualise.

The Africa Race

GRADUALLY the regulations which are to govern the air race from London to Johannesburg, scheduled to start on September 15 next, are taking shape. The Royal Aero Club, in charge of the organisation, has announced that compulsory controls will be established at Vienna, Cairo, Khartoum and Salisbury. This, then, will be the route taken by the competing machines, and the ability of any one to fly longer stages than these will not benefit the machine.

Another interesting item is the announcement that the winner of the £4,000 prize for the fastest time in the speed race will not be eligible for the handicap prizes. This means that the most the winner can gain is the £4,000 prize, while in the handicap the maximum is £3,000.

Last week *Flight* mentioned a number of British aircraft types already in existence which would stand a fair chance in the speed race. To that list might now be added the Miles Peregrine, which has lately been putting up some rather amazing speeds.

Poux on Trial

IT would appear that the *Pou-du-Ciel* is, after all, to be tested in the full-scale wind tunnel at Farnborough. The decision will be welcomed by many in this country as it should result in deciding once and for all whether one or more combinations of c.g. position, wing stagger and gap can be assumed safe and stable. Also, it is to be hoped that limits may be established for the degree of variations permissible before the risk of serious instability sets in.

France has already decided to initiate experiments in the new large wind tunnel at Chalais-Meudon; it would be well if the two research establishments were to receive definite instructions concerning the particular aspects which each should study, otherwise there is risk of considerable duplication and overlapping, with consequent waste of time and money.

Possibly it might be found feasible to let one establishment experiment on the effects of wing positions, centre of gravity, and so forth, while the other concentrated more on what one might term the dynamics of the problem. For example, some pilots have found that the machine behaves in a peculiar manner if the throttle is worked at all brusquely. The effect of the slipstream and its sudden appearance or disappearance seems to be considerable, and it is probably this rather than the effect of a somewhat high thrust line which may give rise to difficulties. There are many other problems, and for any one establishment to probe them all would take a long time. That is why *Flight* suggests that the work should be divided between the two countries in accordance with some prearranged plan.

Some idea of the number of visitors and machines can be gathered from these photographs, though only about a third of the visiting machines can be seen. In the left-hand picture the Monospar Ambulance can be seen in the foreground, while Mr. Brie is demonstrating the Autogiro.

SEASIDE AIRPORT

The Official Opening of the Brighton, Hove and Worthing Municipal Airport : A Brilliant Gathering Watches a Well-staged Display

(Illustrated by "Flight" photographs)

AFTER a morning on which those pilots who had been unable to beg, borrow or steal an aeroplane (in order to attempt to win the handsome prize for the sealed arrival competition) found themselves feeling only too glad to be able to proceed by road with a clear conscience, the weather cleared pleasantly for the real programme at Shoreham on Saturday. There must have been something like eighty machines and five thousand spectators on and about the new airport on that day, and most of them were confident enough to appear with neither coats nor hats. The rain held off.

Fortunately for the hearts of both arrivals and control officers, a full hour was permitted for this sealed-time arrival competition, and during the official luncheon the winner's name was announced—Mr. S. W. Ogden, who arrived in a Spartan from Lympne just two seconds after the secretly appointed time. Mr. Ogden is working for his "B" licence and no pilot is likely to make better use of the prize money.

The Ceremony

At the luncheon Alderman F. W. A. Cushman, the chairman of the joint airport committee, said that the three towns had spent some £60,000 on the scheme, and hoped that the money would be returned in advertisement value, even though there could be little hope of a direct profit for some years to come. He read a message from Lord Swinton, and afterwards the three Mayors—Councillors Edward Denne, J.P. (Brighton) and C. S. Loadman, J.P. (Hove), and Alderman William G. Tree, J.P. (Worthing)—completed the ceremony.

Meanwhile, that veteran "504" expert, Mr. Cecil Pashley, the chief instructor of the South Coast Flying Club, gave an unparalleled display of crazy flying with a Clerget-engined 504N, blipping his motor at crucial moments in order to provide the ultimate thrill. He must certainly know by heart the position of every vertical projection in the immediate vicinity of the airport buildings.

No less stirring, though in a much less heartfelt fashion, was Mr. "Bill" Thorn's aerobatic display with an Avro Cadet fitted for inverted flying. His show, from bunts to the slowest of slow rolls, was a joy even to those who had seen Mr. Thorn's exhibition in years gone by. No aerobatic pilots can have their inverted banked turns more accurately ordered than his.

Of the parade of civil aircraft, little can be said except that the majority of the pilots managed to get out of turn and that a few repeated their "fly-pasts" while others were coming in to land. Knowledgeable spectators hoped that the pilots could see all the other machines converging upon them from almost every quarter. The sensible ones curtailed their demonstrations in the interests of safety.

The same problem cropped up later while three ultra-light machines were being effectively demonstrated together. These were the B.A.C. Super Drone (flown by Mr. Kronfeld), the Aeronca (flown by Mr. Hill), and the Puttnam *Pou* (flown by Mr. Collins), and each machine has a totally different range of view. Once again, the converging attacks on the airport buildings by two or more pilots, who might or might not have seen one another, were distinctly emotioning to all, perhaps, but the pilots themselves.

Mr. R. A. Brie has learnt no new tricks with the C30 Autogiro, but his demonstration has now been polished up to such an extent that there can be nothing new to learn. One is consistently amazed at the skill with which he handles the throttle during his vertical descents and dead-slow passages in front of the spectators.

For the majority of those present the display of formation aerobatics by a flight of Gloster Gauntlets from No. 19

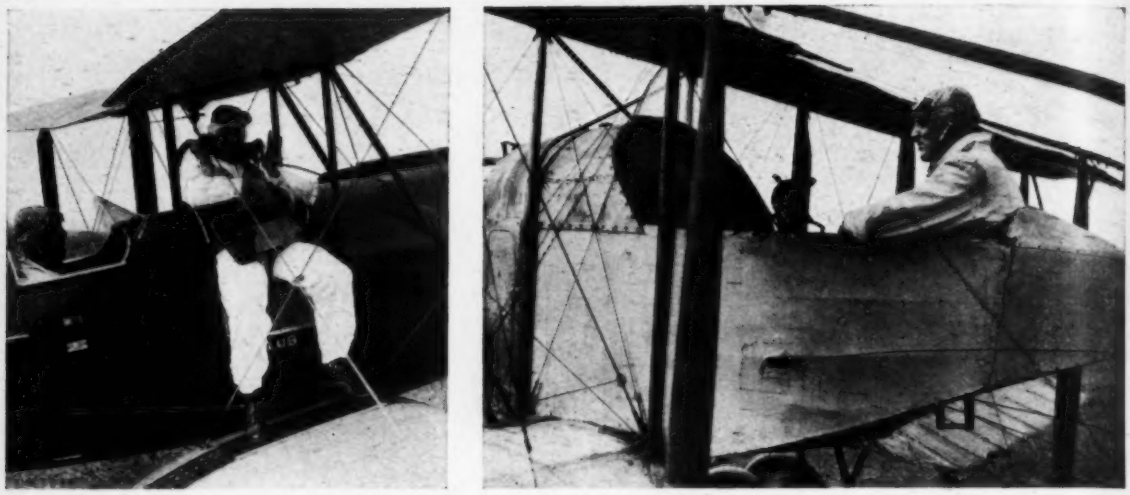
A demonstrating pilot's view of the airport buildings — and the crowd. The photograph was taken from the Monospar while Mr. Seth-Smith was making his "fly-past."

Looking back: A photograph of the Brothers Pashley, taken at the old Shoreham aerodrome, which appeared in *Flight* early in 1914. The aerodrome was actually opened in 1910.

The Miles Hawk Six, flown by Mr. Humble, rounds the airport turn in the South Coast Air Trophy race. This machine eventually won at an average speed of 174 m.p.h.

(Fighter) Squadron must have been the great event of the day. There never has been anything quite so clean and magnificently co-ordinated as the work of these three pilots, led by Flt. Lt. H. Broadhurst. The fact that there was a low ceiling of broken cloud only served to add to the effect and to show the high standard of flying. As a spectator remarked, the Gauntlets move through the sky as one machine which is doing loose rolls and wide loops with a big reserve of power. Some remarkable aerial pic-

Official opening: The three Mayors perform the ceremony. On the left is Councillor Denne of Brighton, Councillor Loadsman, of Hove, unlocks the door, and Alderman Tree, of Worthing, is on the right.



Old and new: Mr. Ken Waller prepares to take up Mr. Gwynne Johns (who should have been glad of his parachute in this position, which he retained until the jump); and (right) the ancient Caudron. Everything is sartorially in keeping save the telephone tubes, which were *not* used in 1912.

tures of the trio in action, taken over the aerodrome at which they are temporarily stationed, appear elsewhere.

History (in which Shoreham has an old-established niche) was represented by the pre-War Caudron, flown modestly and accurately by Mr. Ken Waller. Both in ease of starting and quickness of take-off the Caudron had the laugh when compared with the majority of modern aeroplanes. It even *appears* to be easy to fly, though one never knows with Mr. Waller at the helm.

After the first heat of the South Coast Air Trophy race, of which more anon, three D.H. Tiger Moths, flown by instructors of the Sywell Reserve school, gave an admirable exhibition of formation flying and aerobatics, and the well-known flour-bombing act was put on by Messrs. Max Findlay, Cecil Pashley and I. Mackenzie, who, incidentally, had led the formation flying a few minutes before. Mr. Gwynne Johns then decorated the outside of a Gipsy Moth, while Mr. Waller flew it around in an endeavour to find a suitable gap in the clouds before the former baled out. The gap eventually coincided with the position of the sun, so far as the majority of the spectators were concerned, and only those in the control tower were able to see the actual departure. Mr. Johns descended safely in the old aerodrome.

It appeared that some of the competitors in the first heat of the race for the trophy presented by Mr. H. Stavers Tiltman, the architect of the Shoreham buildings, had difficulty in finding the turning points, and this fact may or may not have explained the result. Messrs. Dancy and Rowarth were not likely to be caught again by the unexpected velocity of the ultra-lights, and the commanding win by F/O Clouston in the Aeronca was somewhat surprising. Mr. W. Humble (Hawk Six) shot round, as usual, from scratch, and proceeded to hoist himself into second place after the original second, Mr. Allington, had been disqualified for failing to turn correctly at Dyke Hotel. Mr. A. Henshaw (D.H. Leopard) thus came into third place.

These placings were almost identical in the case of the following day's final, which was won by Mr. Humble at an average speed of 174 m.p.h., with Mr. J. D. Kirwan (Aeronca) second at 79.5 m.p.h., and Mr. Henshaw third at 131.25 m.p.h. F/O Clouston actually arrived first again in the final, but withdrew owing to an error in his entry form details.

Foreign Guests

Altogether, the two-day international meeting can be considered as a huge success. Despite the weather, there were aerial visitors from Belgium, France, Germany and Holland, and among those present on the Saturday was Mr. J. G. Gibson, the Deputy Director of Civil Aviation. Mr. F. D. Bradbrooke must be congratulated for his excellent work at the microphone during the two days.

The airport is, incidentally, managed for the committee by Lord Amherst, on behalf of Olley Air Service, and ample publicity was given to the event by Mr. Gordon Freeman, the pilot of the Aerial Sites' Avro, which, during the mornings, towed a perfectly good banner, bearing the slogan, "Visit Brighton Airport To-day." Let us hope that the public visits it *every* day. On Saturday and Sunday such a visit was somewhat expensive for any who demanded entry to the sacred precincts of the terminal building—and it is the public which is expected to spend its hard-earned money on flying. Shoreham, we hear, will shortly have direction-finding equipment in action.

Forthcoming Events

June 13-19. Hungarian Pilots Pic-Nic.
June 20. Opening of Gosford House Landing Ground, Longniddry, East Lothian.
June 27. Royal Air Force Display, Hendon.
July 2. Aero Golfing Society: *Flight* Trophy Competition.
July 2-5. Belgian Aviation Clubs: Tour Aerien Belgique.
July 10 and 11. R.Ae.C.: King's Cup Race.
July 18. Portsmouth Aero Club: Isle of Wight Race.
July 23-26. R.Ae.C. Week-end Aerien.
August 1. Cinque Ports Club: Folkestone Trophy Race.
August 1-3. Yorkshire Gliding Club: Open Meeting.
August 2-15. Yorkshire Gliding Club: Instruction Camp.
August 3. Ramsgate Airport: *Pou-du-Ciel* Race.
August 8. Reading Aero Club: Northesk Cup Competition for Women Pilots.
August 15-30. Yorkshire Gliding Club Open Meeting and Competitions.
August 22. Midland Aero Club: "At Home" and Contact Air Race.
August 29-30. Cinque Ports Club: International Rally and Wakefield Cup Race.
August 29-Sept. 6. British Gliding Association: Annual Competition, Gt. Hucklow, Derbyshire.
August 30. Gordon Bennett Balloon Race, Poland.
September 5. Bristol and Wessex Aeroplane Club, and Bristol Branch, R.Ae.S.: Garden Party.
September 5-6. Aero Club of Hungary: Week-end Aerien.
September 12. London Aeroplane Club: Hatfield Garden Party.
September 13. Aero Club de France: Coupe Deutsch Race.
September 15. London-Johannesburg Race.
September 19. Cardiff Aeroplane Club: London-Cardiff Race.

Correspondence

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters intended for publication in these columns.

DE-CLUTCHING THE PUPIL

I WAS much interested in a recent letter in your columns signed "Non-Freezing Pupil." Presupposing the mechanical efficiency of the device suggested, there seems to be a lot to be said for the idea. I myself have missed the ground by fifty feet or so when pulling out of a dive caused by a hefty pupil freezing on to the controls!

In any case, I believe that circumstances could arise where such a "de-clutching" system might result in the saving of two or more lives, and surely anything which promotes safety in aviation should be encouraged.

I should be particularly interested to hear the views of other instructors (may I suggest that Mr. Pashley would be worth hearing on this matter?) and the G.A.P.A.N. on the possibility of the practical application of such a "de-freezer" for pupils.

INSTRUCTOR.

London, W.11.

UNSEASONABLE TOPIC

"A. VIATOR" states in last week's issue that ". . . when cloud is not actually on the ground the pilot merely drops down to a warmer layer of air and melts the stuff [ice] away." He then continues with references to Swissair ice-formation charts, and says, "At certain heights the probability of ice formation is shown."

Is it not logical to assume that dropping down to a warmer layer (if, indeed, a warmer layer is encountered by dropping down) might, if the moisture content of air was great, accelerate rather than diminish ice formation?

Pilots of standing and experience have frequently found that climbing from 5,000 to 8,000 ft. has considerably diminished ice formation.

I write as a student of aeronautics desirous of enlightenment.

JOHN G. MATHIESON.

Southend Flying Club.

AIR-DISPLAY ORGANISATION

NOW that the great day at Gatwick has come and gone perhaps you can kindly find space for this letter in addition to your most able review, last week, of the opening ceremonies and air display which I was privileged to organise for British Airways, Ltd., and Airports, Ltd.

First of all I would like to take this opportunity of thanking all the private owners who turned up in such gallant and amazing numbers. We had planned to have them arrive just as the special train drew in, so that the distinguished guests would see an airport with much business going on. This succeeded, for 100 machines came in during the half-hour of the arrival competition. Every pilot will in due course receive from me a souvenir tankard. It was not possible to distribute them on the field, as most pilots flew away immediately after the display.

If we were not able to have all the private owners at the official luncheon, the reason was solely because of the problem of accommodation. Hence two luncheon parties were arranged. This problem is likely to grow more acute in future years. The pioneers among private owners are now mostly distinguished persons holding responsible posts in the development of civil aviation. On their merits both as pilots and administrators they are entitled to be invited to the more official function. The ranks of the private owner are now joined by a newer generation, none the less welcome, which has still to make its mark on aviation and to contribute something towards its progress.

Time was when the private owner was the backbone of an air display. His arrival in impressive numbers in the days when all machines had letters beginning with G—AA drew the "gate," while he was relied on to give the show as well and, of course, he was always a volunteer. Those days have passed, since manufacturers are now keen on showing off their products at the bigger air displays, and their test pilots are able to put up a professional show.

At the Gatwick Official Luncheon some 700 invitations were sent out and 487 people accepted, while seats were laid for 531 to allow for last-minute acceptances. Actually we were host to 580 guests, and a few had rather a struggle to get in. This was entirely due to the fact that many did not trouble to reply and accept or refuse their invitations, despite appeals by letter to all of them a few days before June 6. Then a number turned up, despite the fact that they had not responded; this sort of thing will have to be guarded against in future.

While as time goes on the private owner will tend to take a less conspicuous part in air displays than formerly he will always be welcome, and, I think, should always be given the now traditional hospitality of lunch and tea, and some contest such as an arrival competition or an air race, both to get him in to time-table and to stimulate his prowess and foster private ownership.

The fact that larger aircraft are now available raises another problem. Many people will arrive at displays by air, and once they are in it is not so easy to make sure they pay their admission charges. I made it a rule at Gatwick that the pilot and one passenger should be guests, and I think this is fair enough to all concerned. Numbers beyond two per aircraft are merely passengers and should be treated as members of the public. They will have arrived by air, commendably, to suit their own convenience, but do not do anything more towards the successful running of the show than the pilot's presence does.

The problem of control of aircraft grows more acute at these displays, especially at a commercial airport, and I should like to take this opportunity of expressing thanks to Capt. Jeffs and Capt. Lamplugh, who achieved a record in getting 100 machines safely put away in 26 minutes, and who ran the programme of events nicely to time-table.

One pilot who came as a private owner and a guest was not asked to take part in the display, but he sought permission to "shoot-up" the crowd either during or after the display. This was refused him both by myself and by the control officers. He then deliberately took off and "shot-up" the crowd. He cannot plead the youthful exuberance of a young private owner, since he is a commercial pilot. Steps will be taken at any future air displays I organise to keep such pilots away. One cannot be too strict about a matter like this where the safety of the public is concerned—a matter which is bread and butter to the commercial pilot himself.

London, E.C.4. WILLIAM COURTENAY,
Organiser, Gatwick Air Display, for Airports, Ltd., and British Airways, Ltd.

AIR, ROAD AND RAIL

WE feel we must reply to "A. Viator's" views entitled "A Question of Time" on page 629 in the issue of *Flight* dated June 11.

In the first place, we would state that we are not responsible for the quotation of various time-tables as between Croydon and Gatwick to which he refers, and we certainly do not wish to enter into a discussion as to the various merits of different air lines using different aircraft from different airports.

Your correspondent has got very involved in attempting to make comparisons between aircraft of different speeds operating from different airports; however, that is not the point at issue.

We would, therefore, draw your attention to the following facts:—

(1) The scheduled train service to Gatwick is 38-42 minutes, which is certainly less than the time taken to reach Croydon, especially since the institution of the 30-mile limit and the traffic lights, which in themselves cause variations from day to day.

(2) The distance between Gatwick and Le Bourget is more than ten miles shorter than the distance between Croydon and Le Bourget.

It is therefore obvious that a transport company using Gatwick Airport will get its passengers from London to the airport in a shorter time, and, taking any given aircraft, that aircraft will then reach Le Bourget again in a shorter time than if operating from another airport; and this saving in flying time, with all its implications of fuel, oil, flying pay, maintenance, etc., adds up to important figures in a year's operation.

We now get to your correspondent's suggestion that the problem of arriving machines "must be enough to break a traffic manager's heart—unless there are no winds to bring machines *in before* or *after* time" [our italics].

The answer to these three possibilities is that, if the machine arrives *in* time everything in the garden is lovely; if it arrives *before* time it is lovelier still, as the passengers can have one or more drinks in the attractive snack bar, or even a meal in the restaurant if the wind has been very strong. As to the third possibility, of the machine arriving *after* time, the number of days in the year on which there is a sufficiently strong head-wind to cause the machine to miss the train connection is very small. In addition, there are many more trains passing Gatwick Airport Station than the scheduled semi-fast ones chiefly used by the operating companies, and, although these other trains take about 50 minutes to reach London, the total journey time on these few occasions would still be not more than if operating from Croydon. Lastly, this Company has the liberty of asking the Southern Railway to stop the next train to pass through Gatwick Airport to pick up passengers from an aircraft delayed by wind, and, in any case, we believe that the operating companies allow themselves a few minutes on the return journey to guard against this possibility—which can easily be done and still achieve a shorter time from city to city as against using another airport.

We naturally do not agree with your correspondent that it is a pity that publicity should be given to the manifest advantages of Gatwick Airport, since the sole object of building this airport was to give the operating companies and the public those very advantages. Further, we would take this opportunity of stressing that, in addition to the above advantages, the use of Gatwick obviates the necessity of negotiating the belt of Surrey hills and that at Gatwick there is much less fog—and it may be this latter fact that makes the advantages of Gatwick so apparent!

Your correspondent's reference to a passenger just catching a train by means of a wild, troglodytic gallop along an echoing subway is particularly unkind when our efforts to provide, as another publication has put it, "an air-conditioned, non-echoing subway" have proved so successful that the real danger is not the troglodytic gallop but the fact that the restful silence might lull the passenger to sleep—although even this is hardly probable, since the total time taken to traverse this silent subway at an ordinary walking pace is less than one minute.

We think the above disproves your correspondent's suggestion that there is no enormous advantage in flying from one airport or another, as Gatwick certainly offers all the above advantages for aircraft bound for Continental destinations.

Incidentally, we should also like to take this opportunity of refuting the suggestion that Gatwick is an "emergency" airport, as we feel the term "emergency" can only apply to a large field used for landing purposes when a proper airport is not available. The term "emergency airport" is misleading and cannot apply to a first-class airport equipped as Gatwick is and which claims to be the closest and most suitable airport for London when dealing with southern-bound traffic.

AIRPORTS LIMITED.
A. M. DESOUTTER
Joint Managing Director.

Gatwick Airport.

THAT ULTRA-LIGHT IDEAL

HAVING been away for a couple of weeks I found on my return the numbers of *Flight* of May 7 and May 14, in which Mr. Boddy, Mr. Richardson and Mr. F. Munro Dingwall answer my remarks on Mr. Boddy's original article *re* the ultra-light aeroplane.

Though by now the topic has lost its first flavour and many readers will not even remember what was the subject of discussion, I hope you will grant me a little space for a short rejoinder.

Though I might be well on my way to develop an inferiority-complex after Mr. Richardson's remarks *re* intelligence and boredom, and after Mr. Munro Dingwall's conclusions on what he thinks I want, I am not downhearted yet, because I foster the fond hope that both these gentlemen, and partly also Mr. Boddy, have really missed my point.

Therefore, without going into details again, let me make my opinion clear by putting the matter in a nutshell.

Notwithstanding the renewal of interest in the "ultra-light," I have said, in contradiction to Mr. Boddy's conclusion, that I do not believe the 30h.p., 80 m.p.h. two-seater—in its present form as an aeroplane—to be an interesting commercial proposition.

I do not maintain that there is not to be found a certain number of customers who will be glad to acquire an aeroplane at small cost, with the knowledge that it will be inexpensive in use, but I believe that prolonged operation will lead to disappointment!

Why? Because the essential quality—the *raison d'être*—of the aeroplane in its present form is *speed:* speed which enables it to be used in all sorts of weather, even against strong head-winds—*but*, speed with the adjunction of a comfortable margin between top and minimum, ensuring the ability to get out of tight corners. In this form the aeroplane is still far from being an ideal flying machine, though, within its limitations, it serves a purpose.

That purpose is *not* served by the "ultra-light" plane, with *too* low a cruising speed and *too* little excess of power to ensure quick acceleration.

Aviation for the multitude will come only when we secure the perfectly safe flying machine, able to be used in any weather. And that is just what the ultra-light *aeroplane* is not.

B. STEPHAN

Ankara, Turkey.

THE POU MYSTERY

I HAVE been following the correspondence in your paper with great interest, especially in so far as the *Pou* is concerned. I am disappointed to know that no steps will be taken to investigate the tendency to get into an uncontrollable dive. Investigation has since been promised.—Ed. I understand that the majority of them show no tendency towards this, but the similarity between all the accidents makes one wonder whether the fault may not lie in the actual handling more than in any inherent vice of any particular type. So far as I can ascertain, most of the accidents have occurred after satisfactory circuits, when the pilot intends landing. I have no practical experience other than in the actual construction of a Flying Flea, held up until now awaiting the Air Ministry investigation. The following suggestion must be regarded merely as a suggestion which may contribute towards the knowledge of the behaviour of this machine under certain circumstances.

Suppose I am flying along at about 50 to 55 miles per hour and intend coming in to land. I gently reduce my airscrew speed, allow the stick to go forward, lowering the nose, and come in with the screw turning in relation to my forward and downward motion. Take it that, instead of throttling down gently, I slam the throttle shut; what happens? I am moving at 50 m.p.h. but the screw is moving relative to a speed of, say, 20 m.p.h. Is it unreasonable to suggest that we have virtually, in a nose-down position, "put the brakes on the front end"? The slowly moving screw has a sudden braking effect and, in addition to this, a partial vacuum is created below the front wing; lift of the middle section of this is lost and the nose falls suddenly. The front wing has stalled and possibly the resultant exaggerated front-wing incidence results in increased lift of the rear wing, further aggravating the trouble. With cable controls the pilot can have no remedy other than, if at sufficient height, in opening the throttle wide as a last resort which *might* return the lift to the front wing.

How may we remedy this tendency? By wind-tunnel experiments, of course, but this avenue is closed. We can, I suggest, increase the safety or lessen the risk perhaps by fitting rigid controls, by careful rigging and finally by very careful handling.

Mignet never designed a machine for fancy flying; he cautions us against sudden closure of the throttle and I believe he now approves of the rigid control system.

In addition to these, I should suggest that every builder of the Flea should avail himself of the services of the Air League inspector, who will examine the finished (uncovered) machine for a very modest fee; in addition to this inspection of workmanship we might with advantage have a subsequent examination when the machine has been finished and ready to fly. Wing incidence, positive and negative could be checked, rigging adjusted, centre of gravity in relation to centre of pressure decided and a greater margin of safety assured than is obtainable under the present state of affairs. If the *Pou* is to continue to be the machine of the amateur builder we must take every care in the construction, rigging and handling, but we must, finally and before we fly, have expert advice on these and not trust to our own imagination.

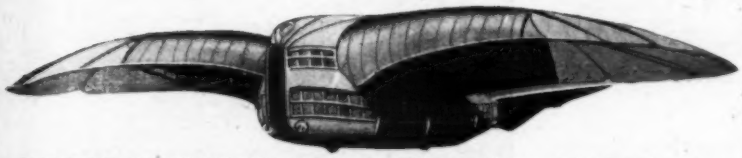
I look forward to reading the opinions of others on this matter.

M. ARMOUR.

Anstruther, Fife.

THE FOUR WINDS

ITEMS OF INTEREST FROM ALL QUARTERS



INTELLIGENT ANTICIPATION? Bearing an odd resemblance, at least as far as the hull design is concerned, to the new Empire flying boats, this "flying machine of the future" was visualised in 1907 by Mr. George L. O. Davidson, of Colorado and Scotland, who (according to the original prospectus, sent by a reader) floated a company for aircraft manufacture in that year. His forecast was "weight, 100 tons; speed, Chicago to New York in 3 hours; capacity, 100 passengers at, say, 10 dollars each per journey."

GERMANY, it is reported, plans to add an aircraft carrier—her first—to her navy.

Two engines with outputs of well over 1,000 h.p. are being tested by the U.S. Army Air Corps.

One is a two-row Wright and the other an in-line model of "X" formation made by the Allison Engineering Company.

A Finnish Commission is said to have gone to the Aaland Isles to choose a site for a new aviation base.

The Aaland Isles, "disarmed and dismantled" after the war in accordance with the Treaty of Versailles, form an important strategic base in the Baltic.

June 7 was the twenty-fifth anniversary of the issuing of an international pilot's licence by the German Aero Club to Mr. Anthony Fokker. With the first machine he designed and built he taught himself to fly.

In connection with the Canterbury Festival, an "Aviation Service" will be held in Canterbury Cathedral next Saturday, June 20, at 2.50 p.m.

A Royal Air Force Ensign and a Civil Air Ensign will be presented to the Dean and Chapter of the cathedral by the Secretary of State for Air.

Twenty-five Years Ago

(From "Flight" of June 17, 1911.)

"During his futile endeavour to catch up the competitors in the Paris to Rome competition Vedrines made a wonderful cross-country speed record on Monday week. He left Dijon at a quarter to nine and at a quarter past nine had arrived at St. Laurent-les-Macon. As the distance between these two points is between 120 and 125 kilomes. his speed must have been in the neighbourhood of 250 kilomes. (150 miles) an hour. This pace was due in a large measure to the strong following wind."

Canadian Vickers, Ltd., have acquired the exclusive Canadian licence to build Northrop machines.

Le Chevalier Willy Coppens de Houthulst, who lost a leg during the war, now commands a Belgian army aircraft group.

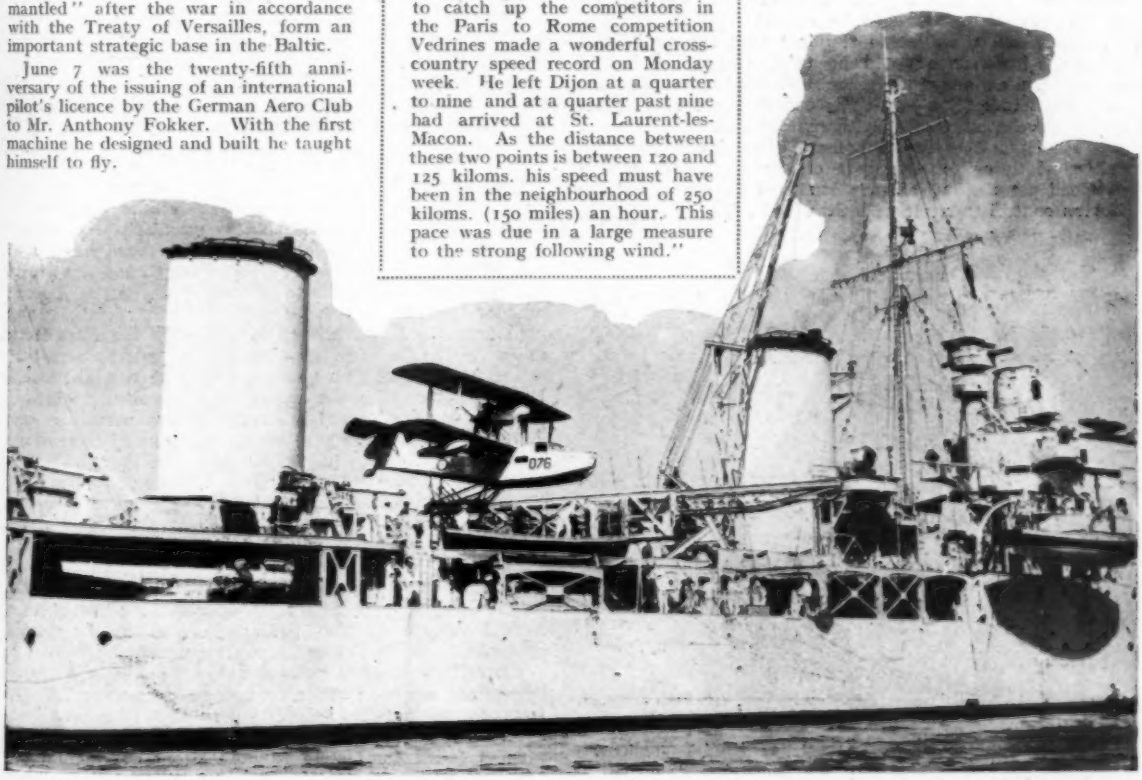
A Fairey Fox has been specially modified for him to fly. It carries a light ladder stowed alongside the fuselage.

Mr. James Livingstone, of Bournemouth, was killed when he fell from an aeroplane in which he was receiving instruction over Negri Sembilan, Federated Malay States.

Two versions of the geared Pratt and Whitney Wasp have recently passed their type tests, in accordance with the latest British Air Ministry's requirements for supercharged engines, in Canada.

Lt. Gen. Kesselring, hitherto chief of the administrative office of the German Air Force, has been appointed Chief of Air Staff in succession to Lt. Gen. Wever, who was killed in an air accident.

A complete reorganisation of everything appertaining to the development of civil and military aviation has been decided upon by the German Government.



ANOTHER WELCOME MAMMAL: According to the dictionary the walrus is allied to the seals but forms a distinct family. In the Fleet Air Arm the Supermarine Walrus amphibian has been adopted for catapult duty, a function hitherto fulfilled largely by the Fairey Seal floatplane. The Hawker Osprey is also widely used. This particular Walrus is shown leaving H.M.A.S. "Sydney" which, like the "Australia" and "Nelson" now carries one of these versatile machines as standard equipment.

DOWN THE BEAM

An Amateur Tries Heston's Blind Approach System : Technique which Requires Only Practice

By H. A. TAYLOR

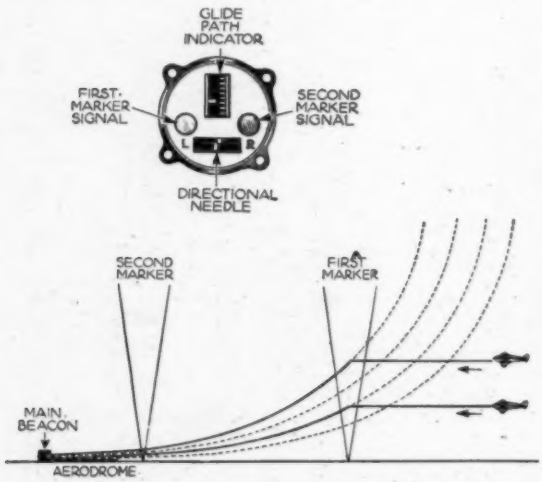
OF all the many aids to bad-weather air navigation none have suffered so much from the tongues and the pens of both friends and enemies as the ultra-short wave blind approach system. Friends have sometimes claimed too much, and enemies have always admitted too little—to the point even of dismissing this aid as providing one more possibility of dangerous failure.

Such a possibility cannot be ignored, but when a blind-approach system is needed it is needed badly, and the only alternative to its use would be to ground all air services. Either the operators submit to an inevitable inferiority in service regularity in comparison with surface transport, or they must go ahead with any device which may eventually permit hundred per cent. reliability.

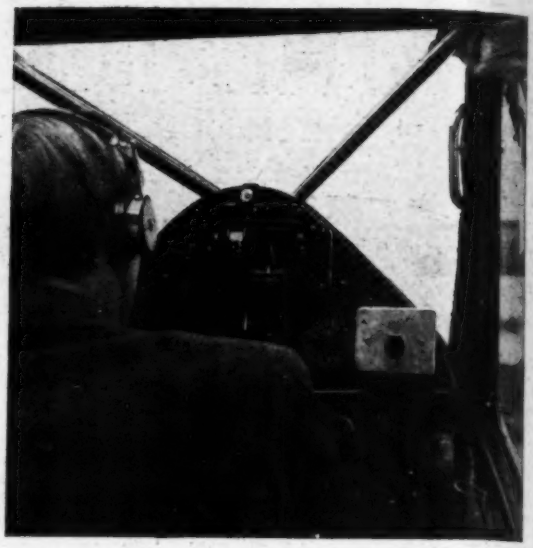
For the reason that the C. Lorenz A.G. have been the first to produce equipment for such a system in commercial form—to the original specification of the German Air Ministry, and after some development work by Diamond and Dunmore in America—this name is somewhat inevitably connected with the whole idea of the blind approach. So far as this country is concerned, Standard Telephones and Cables now hold the Lorenz rights, and the first installation has been arranged for Heston Airport.

Nobody has ever denied the fact that the equi-signal approach indications could be used, but a number of people have expressed their doubt of the real value of the glide path indication—which is one of the corner stones of the development of the Lorenz method.

It was with the idea, therefore, of exploring the difficulties of flying on this part of the equipment that I obtained permission from the Standard Company and the Heston control to try it with Standard's D.H. Puss Moth,



This sketch gives a diagrammatical "section" through the main beam and indicates how machines, which enter at different heights, will reach the aerodrome boundary at the same height if the glide path needle, shown in instrument above, is held in a constant position. A plan of the Heston layout is given on the following page.



The interior of the Lorenz-equipped D.H. Puss Moth on which the tests were made. It will be noticed that the instrument is of the original type; the latest model is shown in one of the diagrams. (*Flight* photograph.)

which for many years has carried various details of experimental equipment, first in the hands of Mr. Samuelson and now of Mr. Auping. It was the latter who showed me that, even in a relatively unstable light aeroplane, it was possible to hold a position in both planes.

The fact that, after a number of trips, I, as a pure amateur and flying solo, managed to keep both needles steady, showed conclusively that the matter is one involving only practice. After a number of hours of experience, I felt that the approach could be made with reasonable accuracy on every attempt.

Things Happen Quickly

One really important impression remains with me. Everything happens so relatively quickly that experience in flying on the system is absolutely essential. No sooner, it appears, has the first marker beacon been heard and passed, the glide path needle been adjusted, and this needle held steady for a moment or two, than marker beacon number two cries out in terms which demand instant and final action. I was gliding or motoring the Puss Moth at 80 m.p.h. for three good reasons. First, because that is the lowest speed at which a transport machine would be likely to make the approach; secondly, because I wanted plenty of speed in case a sudden avoidance was necessary; and, thirdly, because this particular machine is nose-heavy, even with the cheese-cutter right back.

It is interesting to record that it was only during the sixth approach that I actually saw the chicken run enclosing the first marker beacon. On all my earlier approaches I had been guided over and had merely heard it. In "do-or-die" conditions I should at least have made an approach in the correct direction and from the appropriate height—which, incidentally, is difficult to adjust with a normal altimeter. The final approach should be started at about 650ft. to obtain the most convenient results.

After three practice runs at 1,000ft. on the directional indications only—in order to become accustomed to the fact that the needle, as opposed to that of a turn indicator, kicks towards the direction in which one must turn—I failed completely to hold either needle in place when trying both the approach and the glide path together. The difficulties were intensified by the necessity for taking my eyes off the instruments at intervals in order to make sure that no other machine was in the immediate vicinity.

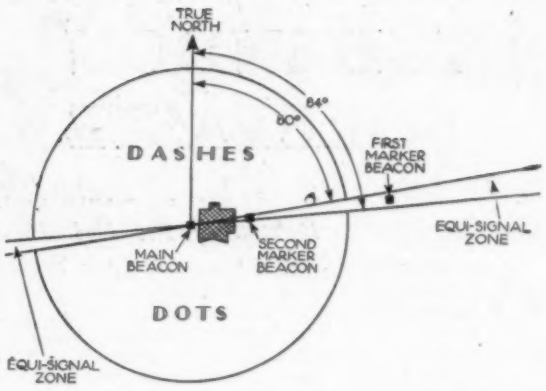
Although making my travels up the equi-signal track with the permission and support of the Heston control, even Mr. Jeffs can only guard against collisions; he cannot prevent them.

At the moment when the first marker beacon's distinctive "peep-peep-peep . . . . " reaches a minor crescendo, the left-hand signal light glows fitfully. At that moment the approaching pilot throttles his engine, switches over to "glide path" and quickly adjusts the glide path indicator to an approximately central position. Thereafter his job is to keep the machine on the beam, and, theoretically, to adjust the glide so that the field strength, or glide path, needle remains in a constant position. The reason for adjusting its position in the first place is merely to give the widest range of movement in both the up and the down direction. Whatever part of the field pattern is entered at the first signal, this indicator will bring the machine towards the airport in an accordingly steepor or flatter approach.

The word "theoretically" was used in the last paragraph simply because the experts allow the needle to fall away during the first part of the approach and centralise it a few moments later—in other words, they cut across the lines of equal field strength. The reason for this is that the shape of the deformed beam in elevation is such as to give a comparatively steep approach during the first kilometre or so, and a progressively flattening one towards the final signal.

My difficulty was to "catch" the needle on the motor after the first relatively steep glide, and to prevent it from descending to the base of the scale after it had been brought down from the top. When flying below the initially selected glide path, the needle is higher than it should be, and vice versa. With a light machine, even a sharp bump will cause this very sensitive instrument to deflect violently and both quick and careful throttle movements are necessary to return the needle and, thereafter, to keep it steady.

However, on my last few attempts I should have made a landing well within the aerodrome boundaries if the throttle had been cut immediately after hearing and receiving the unmistakable call to action of the last marker signals. The approaches were made fairly accurately, but with a series of switchback movements in the glide path.



How the equi-signal track at Heston airport appears in relation to true North. It will be noticed that this track extends on each side of the main beacon, though the needle indications are reversed when an approach is being made from the west. The signals can be picked up at a range of about twenty miles with this particular installation.

On my last attempt I caught the needle, more by luck than good flying, and hit on the right degree of increasing throttle opening so that the needle did, in fact, remain firmly in the centre throughout the entire approach. Obviously, therefore, it *can* be done—and that is all I had set out to prove. After a few hours of practice on any but a day of very violent air disturbances, I feel that I could master the technique.

For the moment, the blind approach run at Heston is limited by legal difficulties concerning the eastern boundary, but the German pilots say that, if the fence could be removed, they would be prepared to use this airport at any time in conditions of virtually zero visibility.

In such conditions, of course, the pilot would be brought up to the airport on bearings and would then fly in an approximately easterly direction for two minutes, switch on the short-wave receiver, turn back, descend to 650 ft., and get on to the equi-signal track. During the approach, a previously checked sensitive altimeter would be used to assist in the work with the glide path indicator.

THE SCHLESINGER AFRICAN AIR RACE

Preliminary Details Announced by the R.Ae.C.

THE Royal Aero Club makes the following preliminary announcement regarding the race from London to Johannesburg for prizes amounting to £10,000 presented by Mr. I. W. Schlesinger:—

The race, which will start from London on September 15, 1936, is open to any type of aircraft provided that the airframe and engines have been entirely constructed in the British Empire. The entrant and pilot, or pilots, must be British subjects.

Each aircraft shall bear an airworthiness certificate of either the normal or aerobatic category.

It is proposed to establish controls at Vienna, Cairo, Khartoum and Salisbury, at which competitors must alight and check in. Intermediate landings will be permitted. There will be no restriction as to the time spent in any of the controls, but competitors failing to complete the whole course within five calendar days will be eliminated. The total distance is approximately 6,500 miles.

A prize of £4,000 will be given to the competitor who completes the course in the shortest time. The following prizes will be awarded to the competitors in the handicap race:—1st, £3,000; 2nd, £1,500; 3rd, £1,000; 4th, £500. For the handicap prizes the aircraft will be handicapped on a formula, particulars of which will be announced later. The winner of the £4,000 prize for the fastest time will not be permitted to receive a handicap prize.

The entry fee, which is £25, must be paid to The Royal Aero Club, 119, Piccadilly, London, W., not later than 5 p.m. on August 1. Late entries at double fee will be received up to 5 p.m. on August 15. The entry fees will be returned in full to all competitors who complete the course within the prescribed five days.

Heat and Expansion

IT is announced that the Heat Equipment Company have moved into larger works at Moorfield Road, Wolverhampton (Telephone: Wolverhampton 22585). This firm specialises in oil-fuel burners for boilers and heat-treatment furnaces of all kinds.

Private Pilot's Equipment

NO private owner or club member should miss the catalogue recently issued by Airco, Ltd. Intended as a guide for the private pilot, and forming a supplement to the general aviation catalogue which will shortly be available, it covers in the greatest detail almost every imaginable item, such as flying clothing, parachutes, maps, log books, and navigation and machine instruments. It is obtainable from the company (of which Capt. Rex Stocken is managing director) at 3, St. James's Square, London, S.W.1.

A HENDON FORETASTE

W/T Broadcasts to be a Feature of the Display : Return of the Set Piece

ALTHOUGH on the whole this year's R.A.F. Display, to be held at Hendon next Saturday week, June 27, will be arranged on the usual lines, there will be certain novelties, perhaps the most interesting being the extensive use of wireless. In no fewer than four events conversations between pilots in the air and between the air and the ground will be broadcast to the spectators.

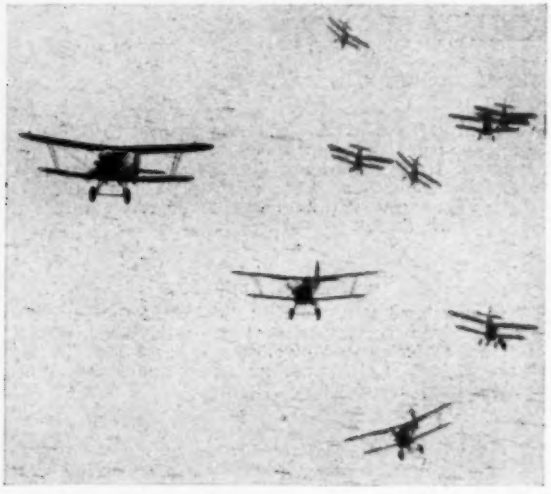
As a combination of entertainment and instruction, the manœuvres of a W/T-equipped Hart Trainer (Kestrel X) flown by an instructor, with a "pupil" in the rear seat, will be hard to better. Were it simply a display of flying this event would be of outstanding merit, because one is shown how (and how not) to do advanced aerobatics, including such items as upward rolls. But its entertainment value is vastly increased by the transmission of the explanations of the pilot and the ejaculations of the "pupil." It is grand fun.

The Gauntlets

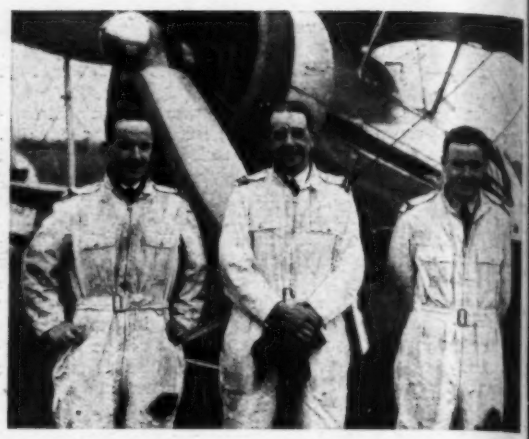
The Gauntlets of No. 19 (F.) Squadron are well to the front this year. In the advanced flying training event the pilot of one of these astoundingly tractable yet high-performing machines explains, from the moment of take-off, exactly what he is doing, and gives an idea of the speeds attained.

No air force in the world has developed flight aerobatics to such a pitch as the R.A.F. If ever the term "hair-raising" was warranted by any exhibition it is that of the Gauntlet flight. Through the medium of his R/T apparatus the flight leader not only gives orders to his two companions but describes each loop, roll, dive and zoom made by his flight.

Everyone seems to welcome the return of the set piece. This year an elaborate power station will be attacked by Nos. 99 and 102 (Bomber) Squadrons, equipped with Heyford heavy bombers and the Harts of No. 601 (F.) Squadron. The defence is composed of No. 17 (F.) Squadron (Bulldogs) and No. 600 (F.) Squadron (Harts). Microphones will be placed in the operations room of the defending forces so that the discussion between the Air Officer Commanding and his staff and the orders given will be transmitted over the speakers. Incidentally, No. 600 Squadron has been practicing a form of attack which makes a most impressive spectacle and (as *Flight*'s representative found when flying as a passenger in the rehearsal held last Friday) provides plenty of excitement for those taking part. Each flight of the attacking Harts forms itself into echelon, and the machines dive in turn very steeply below the raiding formation, zooming up and away on each side. Under favourable conditions the speed of the dive reaches far beyond the 200 m.p.h. mark.



Giving them the low-down : This is what the "savages" in the low attack event see during the initial dive of No. 32 (F.) Squadron. But this is nothing compared with what they are shown after the machines break formation and approach the question from every angle. (*Flight* photograph.)



The Duxford trinity : These are the men of No. 19 (F) Squadron, Duxford, who fly the Gauntlets in the "flight aerobatics" event, illustrated on the opposite page. They are (left to right) F/O. J. R. MacLachlan, Flt. Lt. H. Broadhurst (who describes the manœuvres of the Gauntlets as he leads them) and P/O. B. G. Morris. (*Flight* photograph.)

Another squadron of the Auxiliary Air Force, No. 604, gives a well-arranged and well-flown exhibition of air drill in its Hawker Demon two-seater fighters. Previously this event has been performed only by Regulars.

A novel event is a demonstration of instrument flying by an instructor of No. 11 Flying Training School.

In previous years a popular turn has been that in which a novice tries to imitate the manœuvres of his instructor. This year the aircraft used are Hart Trainers

Certain other events, including the low-flying attack, Overstrand *v.* Furies combat and exhibition of new and experimental types, were commented on in *Flight* last week.

Prices of admission to the main enclosures range from 2s. to 10s. Advance bookings can be made with the Secretary, R.A.F. Display, Hendon ('Phone: Colindale 8242); at any R.A.F. station, or at the usual ticket agencies.

NEXT WEEK'S ISSUE

ON Saturday, June 27, the R.A.F. Display takes place at Hendon, and *Flight* will mark this important annual occasion by the publication next Thursday of a greatly enlarged Special Number. Its contents will include articles on the equipment of the Royal Air Force, on Modern Air Strategy, and on a hypothetical air war. It will also contain a useful guide to visitors to the Display, descriptions of the new machines that will appear there, and a guide to the "static" exhibits at the S.B.A.C. Display at Hatfield. Some remarkable illustrations will accompany the articles. All who are interested in the work of the R.A.F. will find this Special Number a valuable work of reference.

On the following Thursday, July 2, a second Special Number will review the two displays.

NEXT THURSDAY — FLIGHT — PRICE SIXPENCE

To prevent disappointment, a regular order for "Flight" should be placed with newsagents.

TRIPLE TRIUMPH

From the ground, spectators see the "flight aerobatics" event, to be given at the R.A.F. Display by Gauntlets of No. 19 (F.) Squadron as an example of perfect team work, entailing seemingly superhuman co-ordination of speed and manœuvring. From the air, flying near at hand as did *Flight's* chief photographer when he secured this fine impression of the machines starting a loop, a new angle of appreciation is obtainable. (*Flight* photograph.)

KING'S CUP RACE ENTRIES

Twenty-eight Machines of Fifteen Types : All Gipsy Engines : D.H. Dragonfly the Only Biplane

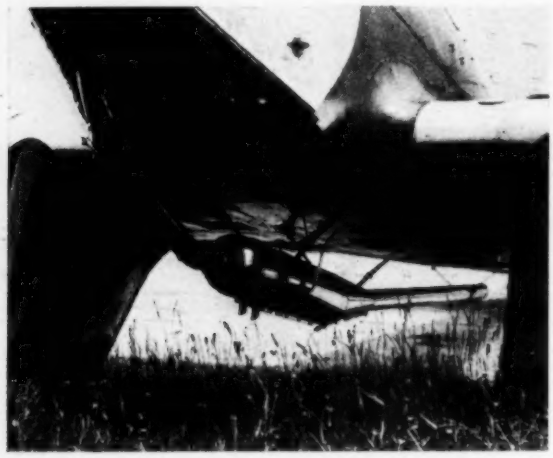
THE Royal Aero Club has now announced the final list of entries for the King's Cup air race, which starts from Hatfield aerodrome, the eliminating contest taking place on Friday, July 10, and the actual race on Saturday, July 11. The eliminating contest totals a distance of 1,224 miles and will be flown over a 612 miles' circuit, with controls at Hatfield, Whitchurch (Bristol) and Shoreham, and turning points at Norwich, Nottingham, Salisbury and Coventry (Anstey).

As the regulations this year stipulate that 50 per cent. of the starters in each class which finish in the fastest time will pass into the final, there will only be fifteen machines in the actual race, viz., 6 from Class A, 7 from Class B, and 2 from Class C. The regulations provided for a maximum of ten from each class, but the number of entries in any class has not been great enough to bring this clause into effect.

Editorial comment appears on page 640.

Class.*	Registration Marks.	Entrant.	Pilot.	Aircraft.	Engine.
B	G-AEKL	H.R.H. The Duke of Kent	Capt. E. W. Percival	Percival Mew Gull	Gipsy VI.
A	G-ADNO	Viscount Wakefield of Hythe	R. J. Waight	T.K.2	Gipsy Major.
B	G-ADOD	Viscountess Wakefield	Flt. Lt. T. Rose	Miles Hawk	Gipsy VI.
B	G-AELE	W. Lindsay Everard, M.P.	P. Q. Reiss	Percival Vega Gull	Gipsy VI.
C	G-AEIN	Lord Willoughby de Broke	Flt. Lt. J. B. Wilson	B.A.4. Double Eagle	2 Gipsy VI.
B	G-AEEM	Sir Charles Rose, Bart.	Entrant	Percival Vega Gull	Gipsy VI.
C	G-ADNA	Capt. G. de Havilland	Entrant	D.H.90 Dragonfly	2 Gipsy Major
A	G-ACRG	W. A. Phillips	Mrs. Amy Mollison	B.A. Eagle	Gipsy Major.
B	G-AEKD	Lt. P. Randolph	Entrant	Percival Vega Gull	Gipsy VI.
A	G-ADNL	P. H. Maxwell	Entrant	Miles Sparrow Hawk	Gipsy Major.
A	G-ADWW	J. H. G. McArthur	Entrant	Miles Sparrow Hawk	Gipsy Major.
C	—	Bateman Scott	F/O. H. R. A. Edwards	Miles Peregrine	2 Gipsy VI.
A	G-ACYO	J. M. Bickerton	Charles Hughesdon	Miles Hawk	Gipsy Major.
A	G-ABWH	W. L. Hope	H. J. Wilson	Comper Swift	Gipsy III.
A	G-ADLA	Mrs. Elise Battye	J. H. Mathew	Miles Hawk Major	Gipsy Major.
B	G-ACTE	W. Humble	Entrant	Miles Hawk	Gipsy VI.
C	G-ADVV	Charles Best	W. L. Hope	B.A.4. Double Eagle	2 Gipsy Major.
A	G-AEGR	Flt. Lt. D. W. F. Bonham-Carter	Entrant	Miles Hawk	Gipsy Major.
B	G-AEKE	Sir Connop Guthrie, Bart.	Charles Gardner	Percival Vega Gull	Gipsy VI.
B	G-AEAB	Lt. D. Misri Chand	Entrant	Percival Vega Gull	Gipsy VI.
B	G-ACTC	Sir John Kirwan	J. D. Kirwan	Parnall Heck	Gipsy VI.
A	G-AEFB	Flt. Lt. A. E. Clouston	Entrant	Miles Falcon	Gipsy Major.
B	G-ADGP	Flt. Lt. R. E. M. B. Milne	Entrant	Miles Hawk	Gipsy VI.
A	G-ABWW	T. H. O. Richardson	Entrant	Comper Swift	Gipsy III.
B	G-ADMI	W. R. Porter	S. W. Sparkes	Percival Gull	Gipsy VI.
B	G-ADLC	C. W. A. Scott	Entrant	Miles Falcon	Gipsy VI.
A	G-ACLO	A. Henshaw	Entrant	D.H. Leopard Moth	Gipsy Major.
B	G-ADZO	Lord Londonderry	R. Falk	Percival Gull	Gipsy VI.

* Class A includes aircraft with engines up to 150 h.p.; Class B covers single-engined machines of more than 150 h.p., and Class C covers twin-engined aircraft.



NOT A SILENCER, but the smoke-box under one of the two Hawk Majors which Major J. C. Savage added to his sky-writing fleet a year ago, and which have given good service. The smoke-producing chemical is fed to the box from a supply tank, and the engine exhaust gases cause the necessary reaction. (*Flight* photograph.)

R.Ae.C. Enclosure at Hendon

MEMBERS of the Royal Aero Club are reminded that there will be a Club enclosure at the Royal Air Force Display. Admission will be by membership badge, and luncheon and tea will be available. Guests will be admitted. Details are obtainable from the House Secretary, R.Ae.C., 119, Piccadilly, London, W.1.

S.B.A.C. Officers

AT the annual meeting of the Society of British Aircraft Constructors the officers for the coming year were elected as follows: Chairman, Sir Robert McLean; deputy-chairman (aircraft), Mr. F. S. Spriggs, in succession to Mr. Hugh Burroughes; deputy-chairman (engines), Air Vice Marshal A. E. Borton; honorary treasurer, Mr. R. H. Dobson, in succession to the late John Lord.

New Oil Process

SOME remarkable claims are made for an oil-processing treatment recently introduced to this country. Known as "Hi-Duti" concentrate, it is said to increase the film-strength of any pure mineral oil to between 100 per cent. and 1,200 per cent., while other desirable qualities are likewise enhanced. The licensees, Delta Processed Oil Products, Ltd., of 1, Albemarle Street, London, W.1, state that these claims have been substantiated by tests carried out on aero and other engines by the Air Ministry. "Hi-Duti" concentrate has proved extremely popular in the United States.

June 18, 1936 Supplement to FLIGHT 652a

The AIRCRAFT ENGINEER

"FLIGHT" ENGINEERING SECTION

No. 125 (Volume XII No. 6) 11th Year June 18, 1936

LIFT SLOPE and DISTRIBUTION on BURNELLI AEROPLANES

A Description of the Method Developed to Estimate the Percentage of Lift Carried by the Aerofoil-Section Fuselage : N.A.C.A. Approve 25 per Cent. for Fuselage and 75 per Cent. for Wings of U.B.-14

By ALEXANDER KLEMIN and BENJAMIN RUFFNER

In "The Aircraft Engineer" of December 26, 1935, was published an article on the aerodynamic characteristics of the Burnelli aerofoil body-wing combination. Dr. M. Watter made certain simplifying assumptions, which enabled him to estimate the probable characteristics. The American National Advisory Committee for Aeronautics have now accepted for stress calculation a lift distribution of 25 per cent. for the aerofoil-section fuselage and 75 per cent. for the wings. The following article sets forth the considerations which have resulted in this concession to the Burnelli Company's claims. The British rights in the Burnelli U.B.-14 are held by W. S. Shackleton, Ltd., of 175, Piccadilly, London, W.1.

THE Burnelli principle of design is well known to many in the aircraft industry. A wide, deep aerofoil section of somewhat larger chord than the root chord of the main wing is used in place of the conventional non-lifting fuselage. One of the main purposes of this type of design is to provide a very large cargo and passenger space without aerodynamic sacrifice and contributing important structural advantages.

It is well known from wind tunnel tests of Burnelli models, verified by flight test data, that this aerofoil body produces considerable lift, and that the wing and aerofoil body combination is practically as efficient in producing maximum lift as a conventional wing of the same total area. The extent of fuselage section lift ranges from 25 per cent. to 30 per cent., depending on the body wing design relation.

From a technical point of view, however, two questions have arisen with respect to this type of design :—

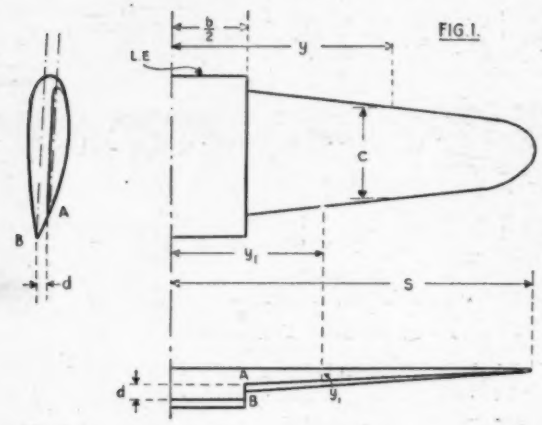
(1) Can the lifting aerofoil body be accepted as an integral and fully effective part of the supporting system as a whole ?

(2) For a particular combination, how should the lift be distributed for stress calculations ?

In an effort to determine quantitatively for the Aeronautics Branch, Department of Commerce, the distribution of lift, the following method of calculation was employed, which has been found acceptable by the engineering section for Burnelli design for A.T.C. stress analysis requirements on approval by the National Advisory Committee of Aeronautics.

In Fig. 1 is shown a typical aerofoil body and wing combination. It will be noticed that, at the intersection of body and wing, discontinuities exist in the side view, plan and rear view. Unfortunately, in the modern aerofoil theory when these discontinuities exist, the use of a Fourier series in representing the lift distribution over the entire wing is not satisfactory. In order to handle this problem from an analytical standpoint, these discontinuities must be explicitly expressed in the mathematics. The mathematical details of this are given fully in the appendix.

The lift is assumed to be equal to that which would be produced by the wing extending over the whole span, plus an increment of lift over the body, which increment is constant over the entire body span. Since this increment is constant over the body span, a loss in circulation must occur at the body extremities. This loss in circulation appears as trailing vortices at this point. In order to represent the discontinuity in side view, as well as in plan these trailing vortices are assumed to come off in a vertical plane extending between the trailing edge of the main wing and the trailing edge of the body. (Points A and B, Fig. 1.) This lost circulation leads to a method for deter-



mining the lift over the body which is compatible with downwash and lift considerations over the entire system.

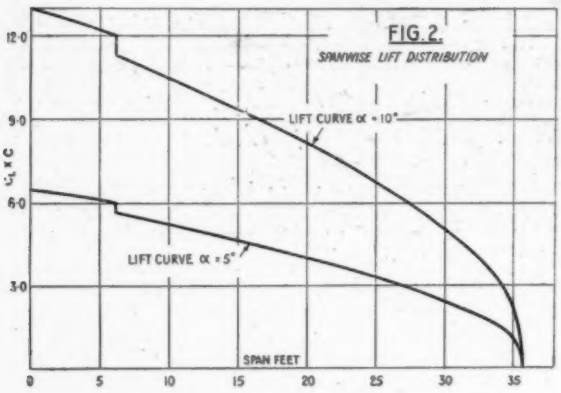
The method developed was then applied to the Burnelli UB14-A Monoplane, which has been successfully tested during the last year and also to the larger Burnelli Bomber which proved of unusually high efficiency based on thorough wind tunnel research.

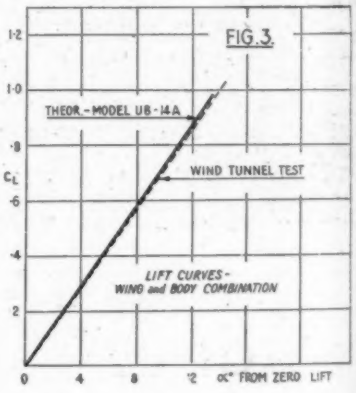
The following is a summary of important physical dimensions and characteristics of this particular aerofoil body combination. (See Fig 1.)

Total semi-span = S = 35.615 ft.
Body semi-span = $b/_2$ = 6.25 ft.
Distance between chord planes at
Trailing edge = d = 2.00 ft.
Chord of body = 280 in.
Root chord of wing = 168 in.
Tip chord of wing = 47.8 in.
Aerofoil section of body N.A.C.A., 4323.
Root chord aerofoil section N.A.C.A. 2412.
Tip chord aerofoil section N.A.C.A. 2409.

In Fig. 2 are shown lift distribution curves for the UB14-A, at angles of attack of 5 deg. and 10 deg. from zero lift. These curves show that the discontinuity at the wing and body intersection, while causing a break in the span distribution curves, does not adversely affect the lift at other points.

If these curves of Fig. 2 are integrated, the lift curve as shown in Fig. 3 is obtained. Also, on this graph is plotted the lift curve obtained from a wind tunnel test of a similar model.





The results of the calculation by this method show:

(1) The aerofoil body acts as a completely effective lifting surface, in spite of its large thickness, and in spite of the discontinuity produced.

(2) Throughout the normal flying range, the body has the effect of producing a continuous lift distribution over the span, except for the break in this curve occurring at the body and wing intersection.

(3) The method developed provides an approved basis for stress analysis giving full and official recognition to the lifting characteristics of the fuselage, a subject very important for structural design in which full advantage is taken of the lift of the fuselage which indicates that the wings are correspondingly relieved of load with valuable saving in weight.

APPENDIX.

DERIVATION OF EQUATIONS FOR DETERMINATION OF LIFT DISTRIBUTION INVOLVING DISCONTINUITY.

Basic Assumptions:

(1) The plan form of the Burnelli type wing combination is assumed to conform to the general shape as given in Fig. 1, with the dimensions represented by the notation as shown.

(2) The circulation is assumed to be represented by a continuous function of (y) which applies over the entire span, plus a constant increment of circulation which is added over the body portion.

(3) The loss in circulation occurring at the points of discontinuity ($y = \pm b/2$) is assumed to be lost between the points "A" and "B" (see Fig. 1), and to come off as a vortex sheet.

With these assumptions:

$$md = \Gamma_i(b/2) - \Gamma_a(b/2)$$

where: d = distance between A and B
m = circulation per ft. being lost between point A and B
Γ_i = circulation between $\pm b/2$
Γ_a = circulation between "$b/2$" and "S" and "$-b/2$" and "$-$S"

If we let:

$$(1) \qquad \Gamma_i = \frac{\pi b A_0 V}{2} + \Gamma_a$$

Γ_a = continuous function of (y)
V = forward speed
$y = -s\cos\theta$

REFERENCES:

Glauert, "Aerofoil and Airscrew Theory."

Van Werner Schmeidler, "Untersuchungen über Flugzeuge mit veränderlichen Flächen." *Zeitschrift für Flugtechnik und Motorluftschiffart*, 1931.

then, if we let $\Gamma_a = 4SV\Sigma A_n \sin n\theta$ in the conventional manner.

$$(2) \qquad \Gamma_i = \frac{\pi b V A_0}{2} + 4SV\Sigma A_n \sin n\theta$$

and: $m \cdot d = \dfrac{\pi b V}{2} A_0$

Then, the downwash at the general point y, due to "$m \cdot d$"

$$= -\frac{m}{4\pi} \tan^{-1} \frac{d}{y_1 - b/2}$$

and the total downwash at the general point y, is given by the expression:

$$(3)\ W(y_1) = V\frac{\Sigma_n A_n \sin n\theta}{\sin\theta} + \frac{m}{4\pi}\left(\tan^{-1}\frac{d}{y+b/2} - \tan^{-1}\frac{d}{y-b/2}\right)$$

$$= V\frac{\Sigma_n A_n \sin n\theta}{\sin\theta} + \frac{A_0 bV}{8d}\left(\tan^{-1}\frac{d}{y+b/2} - \tan^{-1}\frac{d}{y-b/2}\right)$$

The above expression gives the downwash as a function of the coefficients A_0 and A_n.

The lift at any point is related to the downwash by the following expression:

$$(4) \qquad \Gamma = a_0 VC(\alpha - W/V)$$

where: $\theta_0 = \cos^{-1} b/2 \times S$

a_0 = slope of lift curve in K_L per radian for infinite A.R.

V = forward velocity in feet per second

C = chord of aerofoil in feet

α = geometric angle of attack from zero lift

W = downwash velocity at aerofoil in feet per second

$K_L = \dfrac{L}{\rho SV^2}$ = British Absolute Coeff.

b = body span in feet.

Since the angle $(\alpha - W/V)$ will be small we may write:

$$\Gamma = a_0 VC \sin(\alpha - W/V)$$

Therefore:

$$(5) \qquad \Gamma = a_0 VC \sin\alpha - a_0 VC(W/V)\cos\alpha$$

considering:

$$\cos W/V = 1$$
$$\sin W/V = W/V$$

From equations (1) and (5), we may then write:

$$(6) \quad \frac{\pi b A_0}{2} = (a_{0i}C_i \sin\alpha_i - a_{0a}C_a \sin\alpha_a) - (a_{0i}C_i W_i \cos\alpha_i - a_{0a}C_a W_a \cos\alpha_a)$$

where: subscript "i" denotes eddy and subscript "a" denotes autorotating.

If we now write equation (6) at the point of discontinuity, substituting the values of downwash from equation (3), we obtain the first equation connecting the coefficients A_0 and A_n; as follows:

$$(7)\ A_0\left\{\frac{\pi b}{2} + \left(\tan^{-1}\frac{d}{b}\right)(a_{0i}C_i\cos\alpha_i - a_{0a}C_a\cos\alpha_a)\frac{b}{8d} + \frac{\pi b}{16d}(a_{0i}C_i\cos\alpha_i + a_{0a}C_a\cos\alpha_a)\right\}$$
$$= (a_{0i}C_i\sin\alpha_i - a_{0a}C_a\sin\alpha_a) - (a_{0i}C_i\cos\alpha_i - a_{0a}C_a\cos\alpha_a)\sum\frac{mA_n\sin\eta\theta_0}{\sin\theta_0}$$

The other "n" equations relating A_0 to the (A_n)'s are obtained by equating the circulation as originally assumed to the circulation in terms of the downwash expression. These values are written for "n" values of θ.

For the inboard portion between $\pm b/2$, the expression is:

$$(8a) \qquad \Gamma_i = \frac{\pi b V A_0}{2} + 4SV\Sigma A_n \sin n\theta$$
$$= a_{0i}V_iC_i\left[\alpha_i - \frac{\Sigma_n A_n \sin n\theta}{\sin\theta} - \frac{A_0 b}{8d}\left(\tan^{-1}\frac{d}{y+b/2} - \tan^{-1}\frac{d}{y-b/2}\right)\right]$$

For the outboard portion between "$b/2$" and "S"; $-b/2$ and $-S$, the expression (8a) becomes:

$$(8b) \qquad \Gamma_a = 4SV\Sigma A_n \sin n\theta$$
$$= A_{0a}VC_a\left[\alpha_a - \frac{\Sigma_n A_n \sin n\theta}{\sin\theta} - \frac{A_0 b}{8d}\left(\tan^{-1}\frac{d}{y+b/2} - \tan^{-1}\frac{d}{y-b/2}\right)\right]$$

This method has been applied to the Burnelli Model UB14-A, and four terms of the Fourier series seem to be sufficiently accurate. This means that equations (8) are written for the points:

$$\theta = \frac{\pi}{2}, \frac{3\pi}{8}, \frac{\pi}{4}, \frac{\pi}{8}$$

This gives four equations with five unknown.

$$A_0,\ A_1,\ A_3,\ A_5,\ \text{and}\ A_7.$$

The fifth equation between the five coefficients is equation (7). When the value of θ falls within the body equation (8a) is used, and when the point θ falls outside the body, equation (8b) is used.

After the values of A_0, A_1, A_3, A_5, and A_7 are determined, the lift distribution may be plotted as follows:

$$\Gamma = 4SV\Sigma A_n \sin n\theta = K_L CV$$

since the lift per foot is proportional to $K_L C$ we may plot $(4S\Sigma A_n \sin n\theta)$ vs. $(y) = -S\cos\theta$.

The integral under this curve is then taken to K_L (wing area). If this is divided by the wing area, the value of K_L is then obtained.

SUMMARIES OF R. AND M.'s

WIND TUNNEL TESTS OF HIGH PITCH AIRSCREWS. By C. N. H. Lock, M.A., H. Bateman, B.Sc., and H. L. Nixon, of the Aerodynamics Department, N.P.L. R. & M. No. 1673. (29 pages and 9 diagrams.) October 5, 1934. Price 2s net.

In the tests on the original family of airscrews of 3ft. diameter (R. & M. 829)[1] the pitch diameter ratios of the principal series of screws (two- and four-bladers) were 0.3, 0.5, 0.7, 1.0 and 1.5, this range being considered adequate to cover all practical requirements. After a lapse of 12 years, however, the pitch diameter ratios of full scale airscrews have increased almost to the limit of these tests and extreme values of 2.2 have been used. It was decided, therefore, that a further series of airscrews should be tested to extend the range of pitch values to 2.5.

The additional tests were made with the blades of P/D 1.5 rotated to the equivalent pitch values 1.0, 1.25, 1.8, 2.2 and 2.5. Some of the tests on the low pitch screws were made in a closed 7ft. tunnel, but the tests of the highest pitch screws were made in the new open jet tunnel No. 1 in order to use the higher maximum tunnel speed. Thus a comparison was obtained between observations in the closed and open jet tunnels for a number of airscrews, and these support the standard methods of correction for tunnel interference. New apparatus was used including a new 15 h.p. induction motor of 9in. diameter to drive the airscrew. The effect of the airscrew boss was eliminated by using a cylindrical guard body of 0.27 airscrew diameters with faired nose and tail of sufficient length to give a uniform flow in the absence of the screw. The thrust readings were corrected by pressure plotting the airscrew boss, so that the recorded thrust and torque coefficients refer to the exposed portions of the blades only. Instructions are given for correcting the performance data for the effect of interference when the screw is mounted on the fuselage of an actual aeroplane.

The results show that the maximum thrust coefficient for the higher pitches is limited by the stalling of the blades so that after reaching a value of about 0.135 for the two-bladers and 0.26 for the four-bladers, the value of k_T remains very roughly constant and independent of pitch for all smaller values of J. These values are however subject to a scale effect on maximum thrust coefficient of 5 to 10 per cent. for an increase of Reynold's number from 1.8×10^5 to 3×10^5, but there is some evidence to suggest that the full scale values will not differ greatly from those of the model. The torque coefficient increases with increase of pitch at all working conditions. The maximum efficiency for the two-bladers increases slightly from 88.4 per cent. at P/D 1.5 to an absolute maximum of 89.7 per cent. at a P/D rather less than 2.5. For the 4-bladers the corresponding figures are 84.8 and 86.8.

[1] R. & M. 829, Experiments with a family of airscrews. Part I. Fage, Lock, Howard and Bateman.

THE LAMINAR BOUNDARY LAYER ON THE SURFACE OF A SPHERE IN A UNIFORM STREAM. By S. Tomotika, D.Sc. Communicated by Professor G. I. Taylor, F.R.S. R. & M. No. 1678. (14 pages and 5 diagrams.) July 12, 1935. Price 1s. net.

A preliminary study on the laminar boundary layer on the surface of a sphere is made, by starting from the momentum integral equation for the boundary layer on a body of revolution. For the velocity distribution just outside the boundary layer, two cases are considered; in one case, the simple theoretical velocity distribution is employed, while, in the other, use is made of an experimental velocity distribution which has been obtained from a pressure distribution found experimentally in the case when the Reynolds number of the stream is below the critical Reynolds number of a sphere. In each case various quantities characteristic to the laminar boundary layer are discussed and are shown by appropriate curves.

(Other Summaries on page 44a)

CONCENTRATED LOADS on WINGS

The Growing Tendency towards Utilising Wing Space Results in a Number of Concentrated Loads being Put on the Wing Structure : The following Note Deals with the Effects of such Loads on a Two-spar Wing Structure

By J. B. B. OWEN, B.Sc., One-time Meyricke Scholar (Oxon) and Drapers Scholar (Wales)

IN his article on "The Stressing of Monoplane Wings," which appeared in the March 26th and April 30th issues of *The Aircraft Engineer*, Mr. H. N. Horne has shown how great simplification may be effected in the application of the methods of R. & M. 1617 (Ref. 1). His article and the R. & M. quoted are primarily concerned with distributed loads. The practice of mounting engines, etc., on wings introduces, in addition, concentrated loads. The following paragraphs give a brief discussion of the effect of such loads. Attention will be confined to a two-spar wing.

The first process in the methods of stress determination referred to above is to divide any system of normal loading on a wing structure into (1) a system of loads which alone cause nothing but flexure, and (2) a system of torques (Ref. 3). Loads of the first system require that the deflections of the spars are equal at all points. This condition may be reduced to the satisfaction of the equation :—

$$w_a(r_a - R_a) = 2\left(\frac{dR}{dx}\right)_a \int_o^a w_x\,dx + \left(\frac{d^2R}{dx^2}\right)_a \int_o^a \int_o^a w_x\,dx\,dx \quad \ldots \quad (1)$$ (Ref. 2)

for all values of a from o to l. In this equation

w_x is the load per unit run on the wing at the general section distance x from the wing tip,

w_a is the load per unit run at the section where $x = a$.

Other quantities have significance similar to that of Mr. Horne's article ; in particular $r_a w_a$ is the front spar load per unit run, $(1 - r_a)w_a$ the rear spar loading intensity at the section $x = a$.

At a section where a concentrated load is applied, say at $x = c$, the load per unit run becomes very large, *i.e.*,

$$w_c = \frac{\text{Concentrated Load}}{\text{Small elementary length}} = \frac{W}{\delta x}$$

In the limit when the load is absolutely concentrated δx vanishes. Then w_c must approach infinity. But the product $w_c\,\delta x$ is finite and equal to W. Consider the integrals of equation (1) as the limiting value when dx approaches zero of the sum of all such quantities as $w_x\,dx$ from o to a. Whether or not concentrated loads are outboard (or inboard) of the section $x = a$, it then follows that the integrals of equation (1) are real and finite. In fact, this equation may be written for distributed and concentrated load systems as :—

$$w_a(r_a - R_a) = 2\left(\frac{dR}{dx}\right)_a \left[\begin{matrix}\text{Outboard Shear}\\ \text{at } x = a\end{matrix}\right] + \left(\frac{d^2R}{dx^2}\right)_a \left[\begin{matrix}\text{Bending Moment}\\ \text{at } x = a\end{matrix}\right] \quad \ldots \quad (2)$$

At a section of concentrated load as at $x = c$, since w_c approaches infinity, the load per unit run on the front spar, viz., $w_c r_c$ must tend to infinity unless r_c vanishes. In this case the rear spar load intensity $w_c(1 - r_c)$ must approach infinity. A difficulty thus arises in utilising equation (2) at such points. Provided $\frac{dR}{dx}$ and $\frac{d^2R}{dx^2}$ are finite, which is usually the case, the right-hand side of equation (2) is finite. It follows that

$w_c(r_c - R_c)$ is also finite.

But w_c tends to infinity, so $r_c - R_c$ approaches zero, i.e., r_c tends to the value R_c.

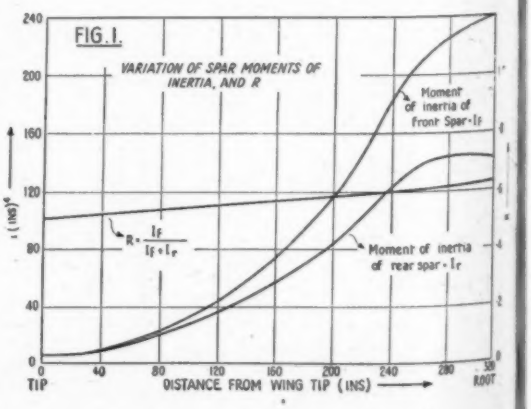
It follows that the load (*not* the load per unit length) on the front spar at this point, $w_c r_c \delta x = r_c W$ must tend to the value $R_c W$. The load on the rear spar is then $(1 - R_c)W$. When the spars are parallel $R_c = \left(\frac{I_f}{I_f + I_r}\right)_c$.

Then the concentrated load is shared between the spars in the ratio of their moments of inertia at the section considered.

The results of the above paragraph and equation (2) therefore determine the partition of a given load system between the two spars so that they deflect equally at all sections. *The difference between the resultant action at each section of this specially partitioned loading and the given loading gives the torque distribution on the wing.*

This method of calculating the distribution of torque obviates the conventional reference to "a flexural line" which, in certain cases, may lead to difficulty, *e.g.* if the distributed load w_v is vanishingly small at the section $x = v$, but the right-hand side of equation (2) is finite : then $w_v(r_v - R_v)$ is finite. Since R_v is finite, and w_v vanishes, then r_v approaches infinity. The torque distribution at the section considered is then that due to vanishingly small distributed load w_v at an arm equal to the "distance r_v" to the "flexural line" which is now at infinity. The actual torque distribution at this section, however, is finite. To calculate its magnitude resort must be made to some other device. The method of paragraph 6 is clearly an easy way out of the difficulty.

The following examples will illustrate the application of the method outlined above. The semi-span of the wing



(1) "Stiffness Determination in Certain Cantilever Wings" by H. R. Cox, J. Hanson and W. T. Sandford, May, 1934.

(2) Cf. R. and M. 1617 equation (8a).

(3) Ibid., paragraph 2.

considered is 320in. The two spars are parallel and at 63in. centres. The variations of I_f, I_r and $R = \frac{I_f}{I_f + I_r}$ along the span are shown in Fig. 1.

In this particular case the variation of R is linear and represented by

$$R = 0.5 + 0.0004 \, . \, x \quad .. \quad .. \quad .. \quad .. \quad (i)$$

The method is still applicable if R does not vary linearly. Using this value of R, (2) becomes :—

$$w_a(r_a - 0.5 - 0.0004 \, . \, a) = 2 \times 0.0004 \text{ (Outboard Shear at } x = a) \quad .. \quad (ii)$$

Case I

A concentrated antilift load of 3,000 *lbs.* 25in. forward of the front spar, 230in. from the wing tip. *No other loads.*

(a) *To calculate the load system to produce equal bending deflections* at all points in the spars, proceed as follows :—

At the section $x = 230$, R = 0.592, so applying the rule of paragraph 5, partition the 3,000 lb. concentrated load as

$$R\,W = .592 \times 3{,}000 = 1{,}776 \text{ lb.}$$

on the front spar and

$(1 - R)W = 1{,}224$ lb. on the rear spar. Outboard of the section $x = 230$ the shear vanishes and so from (ii) $w_a r_a = 0$. Inboard of this section the shear is 3,000 lb., then equation (ii) becomes

$$w_a(r_a - 0.5 - 0.0004 \, . \, a) = 2 \times 0.0004 \times 3{,}000 = 2.4 \quad .. \quad .. \quad .. \quad .. \quad .. \quad .. \quad (iii)$$

But as there is no distributed load on the wing $w_a = 0$. Then in order to satisfy (iii) r_a must become very large, so that $w_a r_a = 2.4$ lb. per in. run. This gives the load on the front spar. The rear spar loading is

$$w_a(1 - r_a) = - w_a r_a = - 2.4 \text{ lb. per in. run.}$$

This distribution is uniform in consequence of the shear being constant and the linearity of R ; for $\frac{d^2R}{dx^2}$ vanishes and the bending moment term of equation (2) does not enter the calculation. The load system to produce equal deflections in the spars is then as indicated in Fig. 2 :—

Calculations at this stage may be checked ; for, if the deflections of the spars are equal, then at all sections

$$E\left(\frac{d^2y}{dx^2}\right) \text{ front spar} = E\left(\frac{d^2y}{dx^2}\right) \text{ rear spar}$$

$$i.e. \left(\frac{M}{I}\right) \text{ front spar} = \left(\frac{M}{I}\right) \text{ rear spar.}$$

A few sections have been arbitrarily chosen to verify this. The result is tabulated below :—

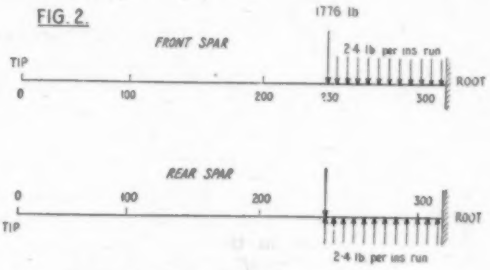
x from Tip.	B.M. on Front Spar. in. lb.	I Front Spar. $in.^4$	B.M. on Rear Spar. in. lb.	I Rear Spar. $in.^4$	$\frac{M}{I}$ Front Spar.	$\frac{M}{I}$ Rear Spar.
Less than 230in.	nil	—	Nil	—	0	0
240in.	17,880	184	12,120	125	97	97
270in.	72,960	220	47,040	142	331	331
290in.	110,880	231	69,120	144	479	480

(b) *It still remains to calculate the torque distribution on the wing.*

The resultant of the above specially partitioned load system is a concentrated load of 3,000 lb. at $x = 230$in. $\frac{1{,}224}{3{,}000} \times 63 = 25.7$in. behind the front spar, together with a uniformly distributed torque of $- 2.4 \times 63 = - 151.2$in. lb. per in. run inboard of $x = 230$, following the aerodynamic pitching moment sign convention.

The actual load system is a single concentrated load at $x = 230$in., 25in. forward of the front spar. To reproduce the actual load system a torque and this only need be added to the partitioned load system obtained above. This torque system consists of a concentrated torque $= - 3.000(25 + 25.70) = - 152{,}100$in. lb. at the section,

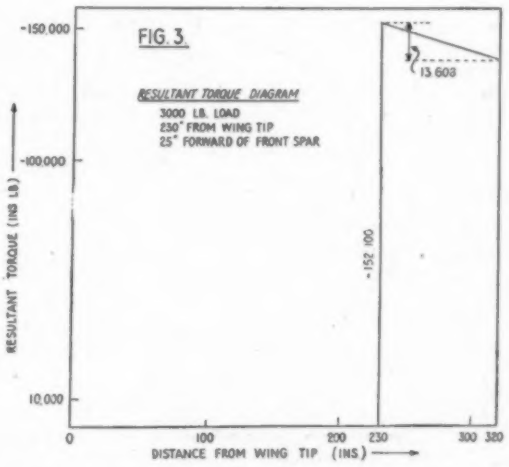
FIG. 2.



LOADING TO PRODUCE EQUAL SPAR DEFLECTIONS AT ALL CROSS SECTIONS

$x = 230$, and inboard of this section a uniformly distributed torque of $+ 151.2$in. lb./in. run. The resultant torque on any section of the wing is shown graphically below :—

FIG. 3.



This torque, following the procedure of R. & M. 1617, is to be split up between the spars, in differential bending, and the skin.

It is important to note that *a concentrated load applied alone on the " R line " i.e.*, divided between the spars in the ratio of their moments of inertia, does not necessarily produce pure bending in the wing. In general it also *twists the wing*. The actual torque on cross-sections in the above example if the load was on the " R line " would increase from zero at the section where the load is applied to $151.2 \times (320 - 230) = 13{,}608$in. lb. at the root.

Case II

Distributed load only over the span. No difficulty should arise in applying equation (ii). Mr. Horne has devoted considerable attention to this question.

Case III

Distributed loads over the span with concentrated loads.

The Principle of Superposition may be applied. Distributed load systems may be treated as indicated in Case II and concentrated load systems as in Case I, the results then added algebraicly.

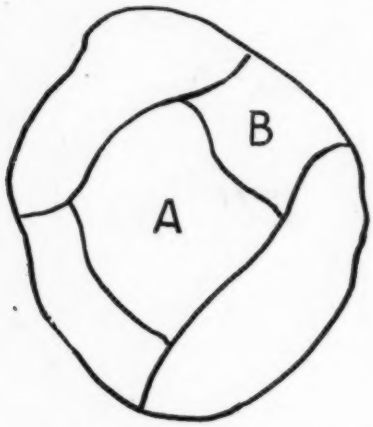
Alternatively, the rule of para. 5 and equation (2) give ready means of dealing with the load system in its entirety.

TORSION on a MULTI-CELL SECTION WITH THIN WALLS

By J. LOBLEY, B.Sc.(Lond.), A.F.R.Ae.S.

THE purpose of this article is to investigate the stress distribution in a multi-cell section, consisting of cells separated by thin walls, when subjected to torque and to obtain a method of estimating the rigidity of such a section.

The author is aware that the problem has been dealt with before and has found these methods very valuable, particularly that due to E. H. Atkin published in *The Aircraft Engineer*, supplement of *Flight* of Sept. and Oct., 1931. It is felt, however, that the method outlined in the present article will appeal to those who prefer to deal with "physical" quantities rather than "mathematical" quantities. In the actual routine application of a principle the physical conception is often preferable since any arithmetical errors are more apparent.



Consider a multi-cell section consisting of n cells A, B, C etc., separated by thin walls and subjected to a torque T. Such a section is shown diagrammatically in the figure. In general, shear stresses will be induced in all the walls.

Instead of the torque T, assume torques aT, bT, cT, etc. to be applied to each cell A, B, C, etc. respectively such that

$$a + b + c + \text{etc.} = 1 \qquad \ldots \quad (1)$$

Now it has been shown that the shear stress at any point on the thin boundary of a single cell section subjected to a torque ψ is given by :—

$q = \dfrac{\psi}{2St}$, where t is the thickness of the wall where the stress is q,

and S is the area enclosed by the boundary.

Thus the shear stress at any point in any wall of the multi-cell section will be the algebraic sum of the shear stresses arising from the torques in the cells on each side of the wall. The stresses in the outer boundary walls will be due to the torque in one cell only.

For example, the stress in the wall AB where the thickness is t is given by :

$$\frac{T}{2t}\left(\frac{a}{S_A} - \frac{b}{S_B}\right)$$

all cell torques are assumed applied in the same sense.

Now assume additional shear stresses to be applied along each wall to bring the total stress at any point in the wall to the actual value, it would have been due to the torque T alone acting on the whole section. Thus for wall AB,

$$\frac{T}{2t}(a/S_A - b/S_B) + p_{AB} = q_{AB}$$

where p_{AB} is additional stress applied where thickness is t, and q_{AB} is stress at this point in actual case when only the torque T is applied.

There will be a similar series of equations for each wall.

Now in the actual case the total shear on the section is zero and the total torque T. But the cell torques aT, bT, cT, etc. give zero shear and a total torque T. Thus the additional stresses must give zero total shear and zero total torque.

This condition can be fulfilled by each additional stress being zero or the additional stresses forming pairs of equal and opposite torques. It follows from the principle of least work that the former is the case and all the additional stresses are zero.

Thus the stress in the wall AB is given by :

$$q_{AB} = \frac{T}{2t}(a/S_A - b/S_B) \qquad \ldots \quad (2)$$

where the thickness is t.

It is thus shown that the applied torque T can be replaced by cell torques aT, bT, cT, etc., such that $a + b + c + \text{etc.} = 1$ and the actual conditions are satisfied.

Now consider a typical cell X. The stresses in its walls are those due to its own torque $_x$T together with stresses from neighbouring cells. Defining the flexural centre of the cell as that point in its plane through which a shear can be applied without causing the cell to rotate, it follows that the cell torque $_x$T and the shear F from neighbouring cells can be replaced by a new torque $_x$T + lF and a shear F through the flexural centre, and the shear F will contribute nothing to the rotation of the cell.

Similarly if q is the stress at any point on the boundary we can write $q = q_T + q_F$ where :—

The stress distribution of q_T gives a torque ψ_1 on the cell and the stress distribution q_F gives a shear passing through the flexural centre.

Now $q_T = \dfrac{\psi_1}{2St}$

and $\theta = \dfrac{\psi_1}{4S^2}\oint \dfrac{ds}{Ct} = \dfrac{1}{2S}\oint \dfrac{q_T ds}{C}$ where θ is the twist per unit length of tube and S is the perimeter of the section. C is the shear rigidity modulus of the material of the section. By definition, the addition of the stress distribution q_F round the section does not affect θ.

$$\therefore\ \theta = \frac{1}{2S}\oint \frac{q_T ds}{C} = \frac{1}{2S}\oint \frac{(q_T + q_F)}{C} ds = \frac{1}{2S}\oint q/cds.$$

Again considering the multi-cell section we see that the value of θ is the same for each cell.

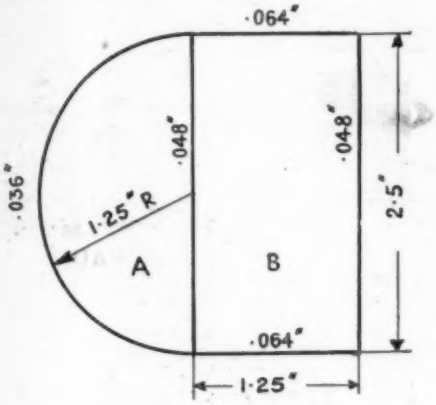
$$\therefore\ \theta = \frac{1}{2S_A}\oint (q/cds)_A = \frac{1}{2S_B}\oint (q/cds)_B = \text{etc.} \qquad \ldots \quad (3)$$

In an actual case C will probably have the same value all over the section. If so :

$$\theta = \frac{1}{2S_A C}\oint (qds)_A = \frac{1}{2S_B C}\oint (qds)_B = \text{etc.} \qquad \ldots \quad (3a)$$

Thus if there are n cells in the section we have n unknowns. Equations (2) and (3) provide us with $n - 1$ equations in a, b, c, etc. and the condition $a + b + c + \text{etc.} = 1$ gives us a total of n equations.

Thus in the general case we can solve for the cell torques and by means of equations (2) and (3) obtain the shear stress at any point and the twist of the section.



Illustrative Example

The diagram shows a section such as might be used as an elevator spar.

Find the stresses and the deflection under a torque T.

$S_A = \frac{\pi}{2} . 1.25^2 = 2.4544$ sq. in.

$S_B = 2.5 \times 1.25 = 3.1250$ sq. ins.

Length of curved web $= 1.25\pi = 3.9270"$.

$$\text{Stress in curved web} = \frac{aT}{2 \times 2.4544 \times .036} = \frac{aT}{.1767}$$

$$\text{Stress in centre web} = \frac{T}{2 \times .048}\left(\frac{a}{2.4544} - \frac{b}{3.1250}\right)$$

$$= \frac{aT}{.2356} - \frac{bT}{.3} \text{ in sense of torque in cell A.}$$

$$\text{Stress in outer straight web} = \frac{bT}{2 \times 3.125 \times .048} = \frac{bT}{.3}$$

$$\text{Stress in flanges} = \frac{bT}{2 \times 3.125 \times .064} = \frac{bT}{.4}$$

$$\text{For cell A; } -\phi\, qds = \frac{3.9270aT}{.1767} + \frac{2.5aT}{.2356} - \frac{2.5bT}{.3}$$
$$= 32.835aT - 8.333bT.$$

$$\text{For cell B; } -\phi\, qds = \frac{2.5bT}{.4} + \frac{2.5bT}{.3} - 2.5\left(\frac{aT}{.2356} - \frac{bT}{.3}\right)$$
$$= 22.917bT - 10.611aT.$$

From equation (3)

$$\frac{32.835a - 8.333b}{2.4544} = \frac{22.917b - 10.611a}{3.1250}$$

$$16.773a = 10.726b.$$

also $a + b = 1$.

from which $a = .390$.

$b = .610$.

$$\text{Stress in curved web} = \frac{.390}{.1767}T = \underline{2.207T}.$$

$$\text{Stress in centre web} = \left(\frac{.390}{.2356} - \frac{.610}{.3}\right)T = -\underline{0.378T}.$$

i.e., stress in centre web is in direction of torque in cell B.

$$\text{Stress in outer straight web} = \frac{.610}{.3}T = \underline{2.033T}.$$

$$\text{Stress in flanges} = \frac{.610}{.4}T = \underline{1.525T}.$$

$$\theta = \frac{T}{c}\frac{(32.835 \times .390 - 8.333 \times .610)}{2 \times 2.4544} = \underline{1.573\frac{T}{c}}$$

TECHNICAL AERODYNAMICS*

IT is interesting to find that books on aeronautical subjects which emanate from America are often written by Professors of Mechanical Engineering, who not only appear to include aeronautics in their subjects of instruction, but are also retained by firms in the aircraft industry as Consulting Engineers.

The particular book under review has been written by Karl D. Wood, who is Assistant Professor of Mechanics of Engineering, Cornell University, and Consulting Engineer to the Consolidated Aircraft Corporation. He should, therefore, be in an excellent position to interpret the work of the scientists in a form usable by the engineers, and he has carried out this task in a very satisfactory manner. His book is intended primarily for the use of students, but it should have a very much wider sphere of usefulness in the Design Offices of the American and British aircraft industries.

The book is, as the author says, compiled mainly from the Technical Reports and Technical Notes of the National Advisory Committee for Aeronautics. Considerable use has also been made of material from Clauert's "Airfoil and Airscrew Theory," Diehl's "Engineering Aerodynamics," and Weick's "Aircraft Propeller Design." These are all standard authoritative works, and the author has made useful selection from them and presented his material in an interesting manner.

The book starts with a comprehensive list of notation, symbols and abbreviations, which is most helpful, while the first chapter deals with the properties of air. Airfoil characteristics are covered by Chapter II and Appendix IV. The circulation theory is well described and its practical use demonstrated. The prediction of the characteristics of airfoil sections is also given in full detail on the basis of the tests in the American N.A.C.A. Variable Density Wind Tunnel.

Other subjects covered are the biplane correction factors and the effects of scale, turbulence and skin friction. A particularly valuable table gives comparative data for the various high lift devices which are at present known.

The various problems in connection with parasite drag are covered in Chapter III and Appendix V. A comprehensive body of data is given for the estimation of the drag of the various parts of an aeroplane, and the examples of such calculations are based on actual aircraft. In Appendix V we have pictures and drag estimates for a large number of varying types of American aircraft, ranging from the Aeronca to the Martin Ocean Transport.

Chapter IV deals with engine and propeller characteristics, and the work on this highly important subject is based principally on the curves of Weick and Diehl, whose authority is unquestioned.

The next two chapters deal with airplane performance and performance estimation, and here the majority of the charts are taken from N.A.C.A. Report 408. This is a very complete and comprehensive method of performance estimation, due to W. Bailey Oswald, of the California Institute of Technology and the Douglas Aircraft Corporation. The principles of performance estimation are the same, whatever method is used, but the work is made easier by accustoming oneself to use one particular set of formulæ and charts drawn up by an expert. The choice of N.A.C.A. Report 408 for this purpose is clearly sound and satisfactory.

The subjects of longitudinal stability and of lateral and directional stability are covered by Chapters VII and VIII and Appendix VII. Formulæ are given for calculating tail and elevator areas, fin and rudder areas and dihedral angle. The limitations of the use of formulæ for this side of design are recognised and pointed out.

*Technical Aerodynamics, by Karl D. Wood, M.E., M.S. McGraw-Hill Publishing Co. Ltd. Price 21s. net.

The first point on which one is inclined to quarrel with the author is in his treatment of spinning. He gives the conclusions reached by his colleague, J. M. Gwinn, with the admission that other authorities disagree with Gwinn on a number of points. The influence of the inertia characteristics on spinning is so completely accepted, at any rate in this country, that it seems unwise to condemn it.

Special flight problems, including calculation of take-off and landing runs, and of range and endurance, are the subject of a special chapter.

Another chapter deals in an inadequate fashion with the important subjects of model testing and flight testing. Early in the chapter appears the remarkable statement that airplane design by building, testing, changing and re-testing models is essentially a confession of ignorance. It is clear, from the author's later remarks, that he does not really mean to claim that we know all there is to know about the aerodynamic side of aircraft design, but model tests have played, and can play, a very valuable part in aerodynamic progress, provided that their limitations are recognised and their interpretation is properly and carefully carried out.

The parts of this chapter which deal with flight testing are also open to criticism. One does not feel that possible customers, or even senior executives, will place the same faith in calculated rates of climb made by assuming the propeller characteristics and using level flight tests only, as they would do in actual climbing trials, even though these have to be subject to correction to standard atmosphere.

The most serious fault in the whole book, however, comes at the end of this chapter on model testing and flight testing. In a stability test of an unspecified aeroplane with an unspecified initial position of centre of gravity it is stated that 60 to 100 lb. of ballast will be necessary to cause instability when flying at 1,800 lb. gross weight. When one adds that the position of the ballast likewise is not specified it is astonishing that such a statement should have been allowed to creep into a book of such a generally high standard as this one.

The book closes with a chapter on hull and float characteristics, containing much useful data, and followed by eight Appendices. Of these, IV, V and VII have already been mentioned, while Appendix VI gives a very comprehensive collection of performance data of current American engines and airplanes. This is very useful now, but it is the sort of information that rapidly becomes out of date.

This is a definitely useful book, worthy of recommendation to all who have to deal with aerodynamic design. As a book for students its value is enhanced by the large number of numerical examples given in each chapter, but these will not interest the older reader. The production is excellent, except for the small size of the illustrations, but it is, of course, realised that this fault could only be remedied by giving fewer of them, which would be a pity. H. A. M.

TECHNICAL LITERATURE

SUMMARIES OF AERONAUTICAL RESEARCH COMMITTEE REPORTS

REPORTS published by His Majesty's Stationery Office, London, which may be purchased directly from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, W.C.2; 120, George Street, Edinburgh; York Street, Manchester, 1; St. Andrew's Crescent, Cardiff; 15, Donegall Square West, Belfast; or through any ordinary bookseller.

STRESS-CALCULATION IN FRAMEWORKS BY THE METHOD OF "SYSTEMATIC RELAXATION OF CONSTRAINTS."—I AND II. By R. V. Southwell, F.R.S. R. & M. No. 1668. (1 page.) May, 1935. Price 2d. net.

Abstract only of paper published in *Royal Society Proc.* A, Vol. 151, 1935.

SOME FEATURES OF THE BEHAVIOUR IN BENDING OF THIN-WALLED TUBES AND CHANNELS. By D. Williams, B.Sc., A.M.I.Mech.E. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1669. (13 pages and 15 diagrams.) February 28, 1935. Price 1s. net.

Stressed skin components and structural elements of the tubular or light channel type are becoming increasingly popular in aircraft structures. As in certain respects the commonly accepted theory of bending is in these cases not applicable, it was considered desirable to examine the bending characteristics of such structures with particular reference to shear stresses and the position of the flexural axis. This report, therefore, deals primarily with the two closely related problems of finding—(*a*) the bending shear stresses induced when a beam of thin-walled section is laterally loaded at its flexural axis, (*b*) the flexural axis for thin-walled sections.

For the case of thin-walled sections, simple and readily applicable solutions to both problems are possible. It is shown that the shear stresses in the flanges of either closed tubular sections or open channel sections, where the flange of the section is wide and its thickness is comparable with, or less than, the thickness of the web, may be important. It is also demonstrated that for the average open section the flexural axis is completely outside the section.

A SUCCESSIVE APPROXIMATION METHOD OF SOLVING THE CONTINUOUS BEAM PROBLEM. By D. Williams, B.Sc., A.M.I.Mech.E. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1670. (21 pages and 13 diagrams.) May 31, 1935. Price 1s. 3d. net.

The solving of a continuous beam problem by existing methods, especially when the loading system is complicated and when there are several bays, is rather tedious and lengthy. The method described in this report seeks to reduce this labour. It is based on the general notion, due to Professor Hardy Cross, of considering a structure one joint at a time, the other joints meanwhile being considered fixed.

The general problem is considered in relation to continuous beams under the following conditions: (*a*) cross section and lateral loading constant over each bay and no end loads, (*b*) as for (*a*) but with end loads, (*c*) constant cross section and end load, but arbitrary lateral loads, over each bay, (*d*) cross section and lateral loads arbitrary but end load constant for each bay.

Detailed numerical examples are given for cases (*a*), (*b*) and (*d*).

The method provides a simple and rapid means of solving the general problem of the continuous beam, offers advantages over other methods in many cases and is capable of dealing with any number of bays.

FLEXURAL AND SHEAR DEFLECTIONS OF METAL SPARS. By I. J. Gerard, M.Sc., A.M.I.C.E., and H. Boden, B.Sc. (Eng.). Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1671. (14 pages.) June 7, 1935. Price 9d. net.

Five typical spars which were kindly supplied by aircraft firms were tested within the elastic limit as simply supported beams carrying one or more concentrated lateral loads. They were also tested with combined end loading and lateral loading, with various ratios of bending stress to end load direct stress; at a selected ratio each spar was tested to destruction. The apparent values of the effective flexural stiffness EI and the elastic shear constant "r" were determined.

The results of these tests have been compared with a large number of similar routine tests. It is concluded that spars may, in general, be divided into three categories according to the material of manufacture, i.e., (1) hardened and tempered steels, (2) relatively softer steels, and (3) duralumin. There is no appreciable variation in EI in category (1), but there is an appreciable reduction in the value of EI towards failure in categories (2) and (3) and this still leaves the problem of how to allow for this reduction when calculating the failing load of the whole spar, as built into an aeroplane, from tests on a relatively short specimen. As, however, most spars at present belong to category (1), further research is not warranted. It will be possible to make assumptions, when dealing with spars in categories (2) and (3), sufficiently conservative to cover the uncertainty introduced by variations in EI when bridging the gap between the test specimen and the spar as built into the aeroplane.

THE CALCULATION OF THE LOADS AND BENDING MOMENTS IN THE MEMBERS OF A PLANE BRACED FRAME WITH RIGID JOINTS. By J. Morris, B.A., A.F.R.Ae.S. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1672. (42 pages and 12 diagrams.) March 23, 1935. Price 2s. net.

A rapid successive approximation process for determining the bending moments in the members of unbraced frames of the portal type has recently been given by Professor Hardy Cross. The possibility of extending this process to the general case of a plane braced frame with rigid joints is here considered.

By taking account of the deflections of the members of a braced frame, a general successive approximation process is developed for determining the end loads and bending moments in the members of any plane frame with rigid joints. In addition, a method is given for obtaining the angular as well as linear deflections of the joints from the results of this process. Several fully worked examples illustrate the application of the process.

For plane frames under practical conditions the process provides a rapid and accurate method of determining the internal loading actions and thus represents a considerable advance upon existing methods. The examples given indicate the importance of end-load-deflection effects in frames under the conditions obtaining in aeronautical structures.

ICE FORMATION IN CARBURETTORS. By W. C. Clothier, M.S., Wh.Sch. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1676. (2 pages.) September, 1935. Price 2d. net.

The phenomena associated with ice formation caused by the evaporation of the fuel have been studied both theoretically and experimentally. Consideration has been given to the prevention of ice formation, by the application of heat either to the intake air or to the surfaces on which ice may form, and by the use of ice inhibitors. An automatic device has been developed whereby an ice inhibitor may be added to the fuel whenever ice commences to build up in the induction system.

The general results of the investigation are given in this abstract of the original paper which has been published in the Journal of the Royal Aeronautical Society, Vol. XXXIX, No. 297, page 761 (September, 1935).

(*Other Summaries on page* 39)

ANOTHER NEW LIGHTWEIGHT

Refined Design and Equipment a Feature of the Luton Buzzard

INTEREST in the design of a new ultra-light monoplane, the Luton Buzzard, is heightened by the fact that its designer is Capt. C. H. Latimer-Needham, who was responsible for the design of the successful Halton light aeroplanes some ten years ago. He also designed the first British sailplane, the Albatross, in 1930. Capt. Needham is well known as a pioneer in the British light aeroplane and gliding movement, and was, in fact, the first in this country to qualify for the international soaring pilot's certificate.

The makers are Luton Aircraft, Ltd., Luton Aerodrome, Barton, Bedfordshire, and the test flying is being done by F/O. K. G. Stodart, who will be remembered as a competitor in the Melbourne Race.

The Buzzard has been produced as a single-seater light aeroplane of low initial cost with small running and upkeep expenses, and which can be housed with the minimum of hangar space. No effort has been spared in the attempt to obtain the highest aerodynamic efficiency practicable, such refinements being included as split-flap gear, trousered landing wheels and wing-root fillets.

A low-wing pusher monoplane, it has a span of 40ft., with 147 sq. ft. of wing surface and an aspect ratio of 10.9. The centre portion of the wing, of 7½ft. span, is built integral with the fuselage, and to this the outer sections attach by three bolts each. Dismantling and assembly are a matter of seconds, and when dismantled the aeroplane may be stored in a space 7½ft. by 20ft.

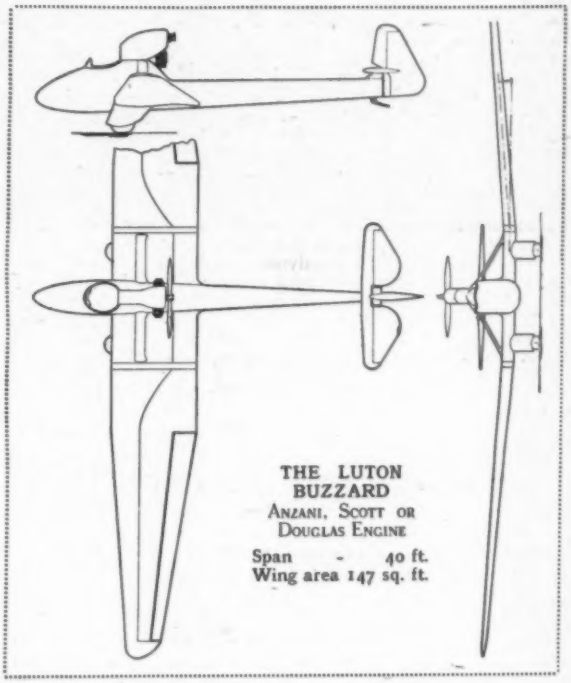
Constructional Details

The fuselage, of clean aerodynamic design, is oval in section throughout its length and decreases in depth at the rear to accommodate the pusher airscrew. The engine is mounted behind the pilot's head fairing, an arrangement which relieves the pilot of noise and at the same time keeps the line of thrust relatively low.

The construction is carried out in spruce and plywood, on sailplane lines The wing has a single main box spar, with plywood torsion-resisting nose and a light secondary spar. The wing has a parallel chord over the central, 15ft. beyong which there is a pronounced taper to the tips. Ailerons run the entire length of the tapered portion. Two short struts, one on each side, connect the wing at the junction to the fuselage top, apart from which the wing is cantilever.

Split flaps are provided along the centre portion of the wing for steepening the gliding angle and reducing the already low landing speed. Specially manufactured Dunlop air-wheels, 17.13in. × 7.43in., are attached to the centre section wing by short cantilever supports, the whole being trousered. The wheels are 5ft. apart, thus providing a wide track giving safety in landing and ease of taxying.

The five-gallon fuel tank, sufficient for a four-hour flight, is



housed inside the fuselage and well clear of the engine, but is easily accessible.

The makers state that the Buzzard has been designed with the exceptional speed range of from 25 m.p.h. to 90 m.p.h., and cruises at 80 m.p.h. The take-off is accomplished after a run of a very few yards.

Normally the Anzani 34 h.p. vee-twin engine is fitted, but alternative units, such as the 34 h.p. Scott Flying Squirrel and 25.4 h.p. Douglas Sprite, are available. Instruments fitted as standard are airspeed indicator, cross level, small aero compass and engine revolution indicator. The provisional price is £325.

The Buzzard was due to make its first public demonstration yesterday.

R.Ae.C. Official Notice

AIR Touring Abroad.—The Private Owners and Air Touring Committee of the Club met on June 10 and considered various questions relating to air touring abroad. The particular items under discussion were prohibited areas and corridors, passports, Customs facilities, foreign exchange, provision of more Customs aerodromes, and the carrying of cameras.

A memorandum was drawn up embodying the recommendations of the Committee, and will be presented by the Royal Aero Club to the annual conference of the Federation Aeronautique Internationale, to be held at Warsaw in August next.

Aeronautics Through the Ages

"THOUGH it may seem a terrible and impossible thing ever to pass through the vast spaces of the aire, yet no question there would bee some men who durst venture this as well as the other." So wrote one W. Marshall in 1638. His first edition of 'The Discovery of a World in the Moone," forms one of the several hundred rare and standard works on aeronautics, from that date to the present day, published in a recent list (No. 846) of Henry Sotheran, Ltd., 43, Piccadilly, London, W.1. The list is one that will provide the bibliophile with an hour or two's fascinating study.

A Summer Camp at Dunstable

ONCE again the London Gliding Club is organising a summer camp at Dunstable, starting at 5 a.m. on July 31 and ending at 5 p.m. on August 14. The camp will have the use of the London Club's fleet of machines, and instruction will be in the hands of Mr. H. E. Hervey. A fee of eleven guineas will cover the full period of the camp, and will include accommodation, service and all flying, the only addition being a nominal fee for temporary club membership.

Isle of Man T.T. Races

ALL who are, or have been, motor cyclists—and there must be a great many in the world of flying—will remember the Tourist Trophy Races in the Isle of Man. Competition, British and foreign, is as keen as ever, and average speeds have risen to unbelievable high levels. This week, actually, is T.T week, and to-day there appears the annual Tourist Trophy Number of *The Motor Cycle*.

It contains a full descriptive account of last Monday's Junior Race in the Isle of Man, together with last-minute news concerning the Senior and Lightweight races, the form and prospects of the favourites, final details of the machines, and other special T.T. news.

Private Flying

Topics of the Day

WHATEVER miseries one may endure as the complete novice—when an otherwise grown-up person is being treated as a child while the machine bounces violently and the throttle leaps out of one's hand—I think that the fairly experienced pilot endures more when being "shown how" in a strange machine. He knows what he is doing; he realises his mistakes as he makes them; yet he is powerless to prevent the expert from harping on the fact that he is holding off high or that he is swinging during a take-off.

It takes a proud and self-confident person to survive early flying lessons without a reduction of personal conceit, and it takes a paragon among instructors to put a bumptious pupil in his place without robbing him of the confidence that is so very necessary. All instructors should be experts in psychology—and most of them are. The exceptions believe that everyone with less than a thousand hours to his credit is an imbecile and, unless the pupil is fairly strong-minded, this idea remains. Let the sufferer remember that lots of very experienced pilots wreck aeroplanes every year through errors of judgment, or through sheer carelessness, while there are any number of hundred-hour amateurs who have never even broken a tail skid check wire.

Which reminds me of the authenticated and recent case of the instructor—a perfect one on this occasion—who was completely baffled by a pupil who shouted at him for letting him make such bad landings!

A Problem Solved

IN the not-so-distant future, perhaps, the pupil will no longer be worried by the psychological effect of continued bad landings and consequent speeches. The pilot leg arrangement, described on p. 662, certainly allows one to glide firmly into the ground without after-effects and permits one to do things which would break up any normal aeroplane.

Even the approach problem is partially solved, since one can, even with the experimental machine, come into a small field in a fast glide (if necessary without checking below 75 m.p.h.) and can apply the brakes almost immediately the machine has touched. This device brings out a point which is not generally realised even by instructors—that the bounce from a bad "wheeler" is not caused by undercarriage recoil, but by the fact that the tail comes down and forces the machine into the air again unless an immediate and very accurate forward movement of the stick is made.

Needless to say, its value as a cure for bad landings is a comparatively unimportant one, but even the best of pilots will prefer to be relieved of the necessity for heavy concentration during the landing process. I have always wanted to be able to drive an aeroplane on to the ground while worrying about control in two dimensions only.

Repetition

NOW that so many municipalities and others are laying out new aerodromes or re-planning old ones, there is a chance that we shall all become as weary of flying displays as we were in the old days when every club ran its own little meeting. As social occasions such affairs are excellent, but it is extremely difficult to think of anything really new in the way of flying events.

Since the encouragement of private ownership—and of air travel generally—is the primary object of the organisers of such affairs, it might be a good idea if they gave the interested public more opportunities of flying rather than of watching other people fly. With at least the possibility of a sale, those manufacturers who support such events might be encouraged to fly interested persons around for a purely nominal charge—or even for no charge at all.

A couple of hours during the period when people are taking tea in relays could be devoted to the inspection of and flying trials in the various machines which are sent over officially, while private owners might be happy to demonstrate the features of their machines on the ground. All *watched* demonstrations display the skill of the respective pilots rather than the value of the machines.

I cannot imagine anyone even considering the purchase of a light or medium-light machine on the strength of a pretty performance by an accomplished pilot. As "sales assisters," flying demonstrations are almost valueless save in the fact that the name is brought before the public. Some of the very best and most useful types do not usually show any of their advantages when seen from the ground. Even a quiet aeroplane is not always quiet inside.

Certainly the organisers of flying displays must think of some way in which interest can be held, or even the most enthusiastic supporters of such events will cease to appear either by road or air. Flying itself, save that seen at the R.A.F. Display, has never been a spectacle since the days when it was a miracle if a machine left the ground, and air racing is usually boring to all save the competitors. The thrill of the Schneider Trophy was concerned with the knowledge that the machines were travelling faster than any; the race itself was nothing. I am usually interested only in the performance of the scratch man—provided that his machine is fast enough.

All the Pouculiarities

IN a moment of mental stress last week I concentrated all the difficulties involved in the flying of the *Pou du Ciel* into two short, if exaggerative, sentences.

A person who has never learnt to fly a real aeroplane will not be able to land the *Pou* successfully, while the person who has learnt to fly may never be able to take one off the ground without damage.

Obviously a special training machine must be devised.

INDICATOR.

FROM the CLUBS

Events and Activity at the Clubs and Schools

YORKSHIRE

CLUB machines put in 61 hr. 50 min. during the week ending June 12. Mr. J. F. H. Naylor, an Air League Young Pilots' Fund pupil, passed his "A" licence tests.

BORDER

Mr. Porter has passed his "A" licence tests and Mr. Robinson his altitude test. Messrs. L. A. Aston, L. D. D. Aston, T. Proudfoot and T. C. Pattinson have become members.

LONDON

Last week's flying time was 145 hr. 20 min. Miss Thornycroft, Messrs. R. D. Adam, J. Bevan-Jones and A. Kein became members. Messrs. L. A. Hart, M. A. Lush, L. K. Olivier and H. G. K. Waring went solo.

SOUTHEND

Thirty-two hours flying was recorded during the week ending June 7. New pupils were Messrs. O'Connor and Ball. Mrs. Rankin and Flt. Lt. Isherwood, both pilots, have joined. Mr. Nicholson is renewing his licence while on leave from Burma.

REDHILL

Four Club machines attended the Reading "dawn patrol." Messrs. D. Cowan and A. Mulder passed their "A" licence tests. During the week ending Friday, June 12, there were four new members, and flying times amounted to 71 hr. 30 min.

HANWORTH

Last week's flying times totalled 57 hr. 30 min. New members were Messrs. P. D. Tayal, Kesho Ram, A. Jelliss, T. E. Hubbard, J. Anstie and R. G. Senanayeke. Messrs. P. D. Tayal and G. Gelauney went solo, while Messrs. P. B. Elwell and Sir Charles Wrench passed their "A" licence tests.

MIDLAND

Dr. Henderson, Messrs. D. L. Lloyd, J. H. Round and C. Hodge have joined as flying members, and Miss E. Streather, Messrs. J. A. Pullin, R. J. Nash, S. B. Kelly, A. B. Willett and E. J. Currey as ordinary members. Messrs. T. M. Pullin, P. R. Burton and P. Danielsen have obtained their "A" licences. Mr. Danielsen went solo. The total flying time for May was 160 hr. 40 min.

EDINBURGH

A good entry was received for the forced landing competition, the leading results on a handicap basis being (1) D. Lowe, Jnr., (2) J. C. Stewart-Clark, (3) N. G. Dryburgh, (4) J. K. Lindsay. Officers of No. 603 City of Edinburgh (B) Squadron, A.A.F., Turnhouse, who presented a trophy for the competition, judged the landings. Mr. T. Campbell Black's air display was given at Macmerry on Saturday, June 13. On June 20 an aerobatics competition will be held. Mr. J. Scott has taken his "A" licence, and a first solo has been made by Mrs. Morison. New members are Messrs. Robertson, Romanes and Yerbury. Mr. W. G. Bibby brought a Hornet Moth over from Renfrew, and demonstrated it to members.

CAMBRIDGE

Marshall's Flying School, the Cambridge Aero Club and the University Aero Club recorded a combined total of 212 hours flying for the week ending June 14. The previous record for one week's flying was 181 hr. 15 min. The School record for a week-day was also broken on June 12 when 36 hr. 10 min. flying was logged and six members took their "A" licences. Those who obtained their "A" licences during the week were the Hon. McClintock-Bunbury, Capt. Joslin, Messrs. Gotch, Dykes, Riley-Smith, Knox-Thompson, Dixon, Gerard and Simpson. First solos were completed by Capt. Joslin, Messrs. Dixon, Gerard, Soloman, Harrop, Leavey and Lingford. New members included Messrs. Dupree, Leavey and Allen.

CINQUE PORTS

Eleven machines and 25 members set out from Lympne for the opening of Gatwick Airport last Saturday week. The Club sent over, in addition, a flight of three machines flown by instructors and bearing a message of greeting to Lord Swinton. As the flight passed over the aerodrome the leader (a Tiger Moth flown by Mr. A. J. S. Morris) was inverted and the flight continued in a tight V formation which looked very well from the ground. On Sunday another successful landing competition was held, the winner being Mr. W. H. Johnson, with Mr. M. C. Campbell second. Since these monthly competitions were recommenced, there has been a great improvement in the accuracy of landings. One is apt to get a little spoiled on aerodromes the size of Lympne, and from 1,000 ft. the two marks, 200 yards apart, look impossibly close together. However, nearly all the fourteen entrants managed to get in between them on at least one of their two attempts. On June 13 several machines went to Shoreham for the opening of the new Club. Amongst these was Mr. C. A. Wilson's new Swallow, which he has just purchased through the Club. The total flying time for the week ending June 10 was 72 hours. Mr. D. G. Walker and Mr. C. E. Curtiss passed their "A" licence tests, and Mr. E. Symonds went solo.

C. A. S. C.

Members flew 4 hr. 20 min. dual and 4 hr. 45 min. solo last week-end.

NORFOLK AND NORWICH

Just on 37 hours flying was done last week. A Heston Phœnix paid a visit.

WITNEY AND OXFORD

There was no flying during the second half of the week ending June 13 owing to bad weather. The total was 18 hours. Lord Allerton and Mr. D. G. Biggart passed the tests for the "A" licence.

ABERDEEN

A spell of exceptionally fine weather has resulted in a marked increase in flying times. Mr. Scott Pierce flew across from Perth last week in his B.A.C. Drone. The school hangar is being extended and a tennis court is being marked out.

DONCASTER

Although the weather was bad and only one Club machine was available, 15 hr. 20 min. flying was recorded during the week ending June 10. Dr. P. E. Pym went solo, and Mr. N. Braithwaite became a member. The Gipsy Moth G-AAVZ is due back from C. of A. shortly.

NEWCASTLE-UPON-TYNE

The flying total for the week ending June 11 was 70 hr. 40 min. Messrs. E. L. Wardle and R. E. Petersen went solo, and Messrs. S. G. Fairbairn, M. P. S. Roberts and L. Sample completed their "A" licence tests. Messrs. R. Emmott, P. A. Woodger and R. Leech, all new members, commenced instruction.

PORTSMOUTH

Adverse weather interfered with flying on one or two days of the week ending June 12, but the flying time totalled 32 hr. 10 min. Weather conditions caused the monthly landing competition to be cancelled. New members were Messrs. H. Gordon Langford, G. M. Buxton, Lt. Cdr. G. F. Renwick, R.N., and Flt. Lt. F. J. St. G. Braithwaite.

BRISTOL AND WESSEX

A joint garden party is being held on Saturday, September 5, by members of the Bristol and Wessex Aeroplane Club and the Bristol branch of the Royal Aeronautical Society. Mrs. P. V. Wills has been appointed a member of the flying committee in place of Mr. G. M. Stock, who has resigned. The flying time for the week ending June 13 was 39 hr. 15 min. Mr. J. W. Whitehead completed the tests for his "A" licence, and Mr. M. H. Taylor went solo.

LEEMING

Yorkshire Aviation Services entertained the visiting foreign pilots to lunch at York Municipal Aerodrome on Sunday, June 7. There were twenty visiting machines. His Worship the Lord Mayor of York received the visitors and proposed their health at luncheon. Mr. J. M. Barwick, M.F.H., President of the York and Leeming Flying Club, welcomed the Lord Mayor and the visitors on behalf of the Club. Herr Schumacher, of Frankfurt, responded in admirable English on behalf of the guests. It is hoped that this rally, the first of its kind to be held in the north, will become an annual function. Unfortunately, owing to the French strike, numerous letters of regret were received from France, but despite very bad weather five Germans and five Spaniards succeeded in arriving at the meeting. Flying time for June up to the 13th totalled 82 hr. 5 min. Messrs. Headlam and Hargrave went solo. New members of the York and Leeming Flying Club were Messrs. Woodhead, Wheatley, Hargrave and Headlam.

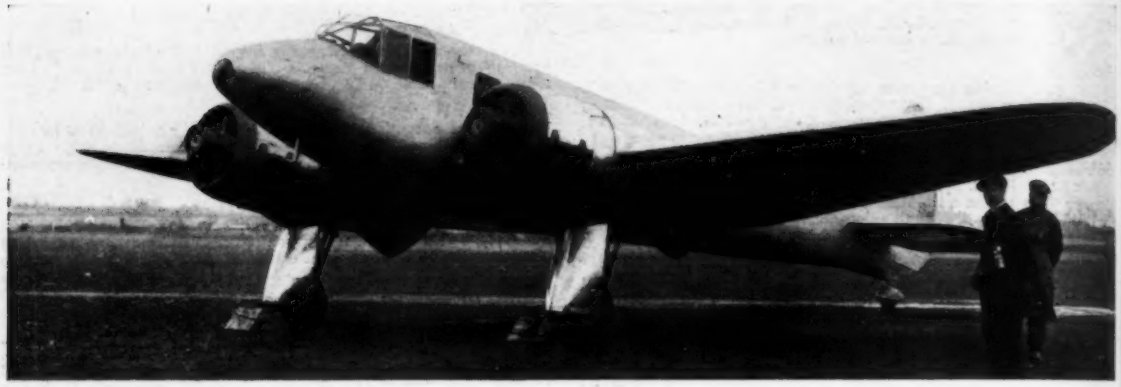
A. S. T.

May saw the commencement of a new term with five new students taking courses lasting two and three years. Other new students include Mr. K. Janabi, of Iraq, who is taking a short flying course, while Mr. Parkhouse has commenced an instructors' course. Amongst those who completed various types of training were Messrs. Oliver and Gearing, who took the instructors' course, Mr. Ingerman, of Holland, a technical course, Mr. Soule, of Canada, a seaplane course, and Mr. Rees. Messrs Keep and Morrison-Bell, and Mr. Ismail, of India, obtained their blind-flying certificates. The aircraft have been augmented by yet another Avro Cadet of the latest type, and flying time during May totalled 1,484 hr. 30 min. Despite poor weather, about 1,500 people attended the Empire Air Day Display. As the result, a sum of £21 was handed to the R.A.F. Benevolent Fund. The public were particularly interested in the air race, the aerobatic display and comic event on the flying side, and most of them took the opportunity of seeing the ground training facilities.

Four days later, on May 27, a party of Oxford members of the National League of Airmen spent two hours inspecting the school activities. They had chartered a 16-seater and flown to Hamble to see the *Queen Mary's* departure from Southampton Water. The new sports ground has been opened for play.

COMMERCIAL AVIATION

— AIRLINES — AIRPORTS —



DEVELOPMENT : The first photograph of the Bristol 143 all-metal monoplane, which is the civil development of the now famous 142. It carries eight passengers and a crew of two and is powered with the Bristol Aquila engines of 500 h.p. each. The undercarriage, of course, is retractable. For the moment, this machine must take second place to the Blenheim bomber, which is being manufactured in large numbers. A rough idea of its speed may be gained from the fact that the prototype was popularly credited with a maximum of more than 260 m.p.h.

THE WEEK AT CROYDON

The Parisian Situation : Using Shoreham : False Alarm : Dawn Departures : Quick Work : Amateur Air Navigation

THE situation was easier in Paris last week, so far as fuel for aeroplanes was concerned, but reports that hotel guests had to fry their own eggs and make their own beds led to a certain number of cancelled air passages. Paris is one of the best places to refute the tiresome proverb about making your own bed and lying on it. An intelligent appreciation of the night life of that city dispenses with the necessity of beds, and breakfast becomes a mere second supper.

Early last week the Earl and Countess of Athlone arrived by K.L.M. from Holland, having been seen off at Schiphol Airport, Amsterdam, by H.M. the Queen of the Netherlands. Sir Eric Geddes returned from Vichy by Imperial Airways D.H.86, piloted by Capt. O. P. Jones, who landed at the new Brighton Airport, as being more convenient to his passengers' destination. Now that Customs can be cleared there, Shoreham forms another useful emergency airport in unfavourable conditions, especially in view of the good train service for London and of the fact that the railway station is next door to the airport.

One day last week somebody elbowed the knob of the Airport fire alarm when aerial activity was at its height. Result, wails of a sort only paralleled by the *Queen Mary* in a fog or by the Airport cat when jammed in a door. Managers and traffic staff dropped teacups, declutched tumblers, and tumbled out to the tarmac, where everyone hung round, darkly suspecting his neighbour of having a secret and selfish fire somewhere. The fire tender cruised round like a rudderless show-boat. It is curious that there is no system whereby indicators may show at what part of the Airport the conflagration is taking place. Many a small but jolly fire may thus be missed by hard-working folk with few joys in life.

British Continental Airways recently accepted as freight the first pair of diplomatic long-distance flying trousers travelling unaccompanied. They were consigned by aeroplane to Frankfurt, and thence by airship to Rio de Janeiro—for the American Ambassador there. Speculation is rife as to why these ambassadorial pants were considered valuable enough for such expensive transport. Were they heavily gold-laced ceremonial bags or steel-lined, bullet-proof ones in case of civil disturbance?

The popularity of long-distance air travel steadily increases in Europe. Saturday appears to be the peak day, and for two or three weeks running K.L.M. has had to duplicate the 7.0 a.m. departure on Saturday. The number of people who think it worth while to arise at the crack of dawn is amazing. You see thirty to forty people in the main hall at that time, and the places they are going to range from Malmö to Berlin, Warsaw, and Rome. Bookings to Oslo are not infrequent also, and this service, of course, gives direct communication with Stockholm, where passengers arrive at 3.45 p.m.

Linking the Airports

People in the aviation business would welcome an air link between Croydon and Gatwick, and it is hoped that Inner Circle Air Lines may provide it. At present the air journey is possible, but only flying enthusiasts with several days' holiday will be likely to undertake it, despite the attractions of Gatwick. I do not vouch for the itinerary, but it is something like this: Leave Croydon at 9.30 a.m. and fly via Birmingham and Gloucester (where the night may be spent) to Torquay, thence to Southampton, the Isle of Wight, and so to Gatwick at about 3 p.m.

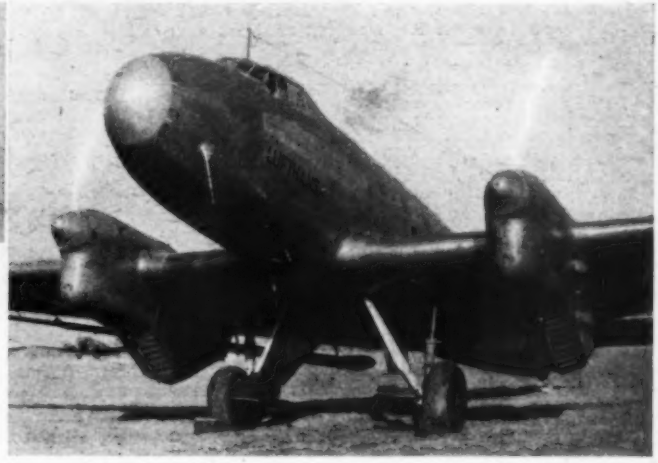
Thanks to the quick work of Rollasons, and also to the admirable way in which the American Stinson is de-

livered in its crates with every possible instruction for quick erection, one of the latest models—sold by Brian Allen Aviation to Mr. Desoutter, of drill fame—was ready to fly away two days after receipt. Rollasons, incidentally, have been fitting the Commercial Air Hire Avro 642 with a special freight-loading trap.

During the usual verbiage over the Air Navigation Bill it was decided to fine anyone five pounds if found trespassing on an aerodrome, and that if there was a right of way across the place people using it were not trespassers. If the aerodrome was a busy one, the use of such right of way would be most likely to incur the death penalty, anyway.

Another solemn provision was that aeroplanes making a forced landing should not be regarded as trespassers. The high landing fees are usually a sufficient penalty without the addition of a fine as well. There would be some sense in making landing fees lighter for services designed to link up airports, and so make long-distance air connections easier for passengers arriving at one London airport and wanting to catch a machine at another.

A. VIATOR.



JUNKERS' NEW "TWIN"

The Ju.86 : British, American or German Engines : 226 m.p.h.

DEUTSCH Lufthansa, Swissair and South African Airways have all placed orders for the new Junkers Ju.86 high-speed twin-engined monoplane. This machine represents one of the finest of Germany's recent aeronautical efforts and is particularly interesting because the Junkers Jumo compression-ignition engine is specified as a standard installation. Alternatively, two Pratt and Whitney S1E-G Hornets or two Rolls Royce Kestrel XVI's may be fitted.

One might regard the Ju.86 as a very much-modernised version of the Junkers S.36 freighter which was built in 1927.

Structurally, the most interesting feature is probably the smooth stressed-skin covering in place of the familiar Junkers corrugated type. The fuselage cross-section is predominantly oval, tapering to a circular form forward of the pilot's cabin and becoming wedge-shaped as it nears the tail.

Somewhat similar in general design to that of the Ju.52, the cantilever wing is in three main portions. Its outer ends are detachable and are fastened to the centre section by ball-joint couplings. The skin is detachable on the underside. As in the Ju.52, the well-known Junkers "double wing" is embodied. Briefly, this consists of an adjustable subsidiary wing or flap carried aft of the main plane. It improves take-off and landing characteristics, and is arranged so that its outer portions serve as ailerons. To avoid damage which might be caused by speeds in excess of that for which the sub-wing is set, an anti-dive device is provided. This is actuated by air pressure, and returns the auxiliary wing to the setting appropriate to the speed.

The tail plane is mounted on top of the fuselage, and carries two cantilever fins and two rudders. A "tab" is provided on the elevator to deal with varying conditions of load.

The undercarriage may be retracted laterally into the centre section of the wing by an electric motor. Sheet metal fairings close the apertures for the wheels and struts. Hydraulically operated brakes are provided for the low-pressure wheels.

JUNKERS Ju.86

Twin engined, High-speed Transport Monoplane

Two Pratt and Whitney Hornet S1E-G Engines 750 h.p. each at 7,000 ft.

Dimensions	
Span	74 ft.
Length	57 ft. 6 in.
Wing area	882 sq. ft.
Weights	
Weight, empty	10,550 lb.
Gross weight	16,450 ,,
Performance	
Maximum speed at 7,000 ft.	226 m.p.h.
Cruising speed at 12,000 ft.	210 ,,
Landing speed with full load	60 ,,
Take-off run	280 yd.
Landing run	205 ,,
Normal range	665 miles
Service ceiling	23,200 ft.

Interior Arrangements

Normally, the Ju.86 is fitted with two Pratt and Whitney Hornet S1E-G nine-cylinder radials of 750 h.p. at 7,000 ft., but, as already stated, the Rolls-Royce Kestrel XVI (690 h.p. at 11,000 ft.) or the Junkers Jumo 205 C are alternative power plants. The three machines for South Africa are having Kestrels. Fuel and oil tanks are carried in the wings outboard of the engine nacelles.

The pilots' cabin is behind the forward luggage compartment and is provided with two seats, placed in echelon to improve the view. Normally entered on the port side, the passenger cabin is provided with a starboard door which can be used as an emergency exit. The cabin usually has ten comfortably upholstered adjustable chairs. Overhead strip lighting is provided, and there are the usual sound-proofing, heating and ventilating arrangements. Aft of the cabin are the toilet and baggage compartments.

Improvements at High Post

HIGH POST aerodrome has been considerably enlarged during the last six months, the total landing area having been increased from 45 to 110 acres. Levelling operations are now in progress, and it is expected that the whole of the area will be available in August. In addition, the workshops are also being enlarged and all classes of overhaul are now undertaken for both aircraft and engines. A fully licensed hotel has been opened, where there is living accommodation for the Wiltshire School of Flying pupils.

The new buildings are situated on the edge of the aerodrome, on the main Salisbury-Amesbury road, facing the High Post golf course.

Commercial Aviation

Lisbon - Madrid

AT the moment the only air link between Lisbon and foreign countries is that provided by the Spanish Postal Air Lines (L.A.P.E.), which run a daily service between Lisbon and Madrid, with connections for other European capitals. During May, 1936, their machines carried, between the Portuguese and Spanish capitals, 140 passengers, 870 kgs. of mails and 83 kgs. of gold for the Banco de Portugal. Although the L.A.P.E. are in their seventh year of operation they claim that no accident of any sort has happened to the machines in service.

British Airways' New Fleet

WHEN British Airways have their four D.H. 86 As in full service, this company will be operating with what are probably the most completely equipped machines used in this country.

Each will be fitted with a P.B. three-axes automatic pilot, a Standard-Lorenz blind approach receiver and Marconi direction finding and two-way radio equipment. A special preparation is also being used to keep the leading edges, struts and so on free from ice and pilots have found, over considerable periods of operation, that this preparation is completely effective.

In addition, engine-driven vacuum pumps are used for the gyroscopic instruments, with Smith's ice-proof pitot heads and specially heated carburetters. Grimes retractable landing lights are fitted and the cabin is both air-conditioned and specially fire proofed. In due course the machines will have D.H.-Hamilton V.P. airscrews.

The through service to Stockholm will be formally opened on July 1, after survey flights have been made over the Malmö-Bromma section and extensions even further to the east are projected, pending the satisfactory conclusion of various necessary negotiations.

100,000 Miles Per Annum

THE Aero Club de France gives prizes every year to the commercial air line pilots who have flown the greatest number of miles during the past year. The awards for 1935 have just been announced, all the winners being Air France pilots who probably fly more individual miles than any other air line pilots. The first prize went to Ronnelle and the second to Lafanchere, with totals of 101,930 miles and 101,670 miles respectively. Special prizes for night flying were awarded to Goret, Parizot, and Rolland, with distances of 37,212 miles, 35,750 miles and 32,360 miles respectively. Goret's and Parizot's mileage was covered between Casablanca and Dakar, and Rolland's on the South American mainland between Buenos Aires and Rio de Janeiro.

The Croydon Accident

AT the resumed inquiry into the crash which resulted in the death of Capt. Ellis Hill shortly after he had taken off from Croydon on May 16, the jury found that the machine "crashed owing to the failure of the petrol supply, but the evidence was insufficient to show how the supply was cut off." The machine was an S.T.4 belonging to Commercial Air Hire.

Capt. Wilkins, the Assistant Inspector of Accidents at the Air Ministry, said that there were no defects in the controls, but that the main fuel cocks were closed.

As these taps are situated behind the pilot it would seem to be unlikely that they could have been accidentally turned off in the air, and it can only be concluded that the machine actually took off when these cocks were in the closed position. In this condition it is still possible to start the engines, warm up for two minutes, and to reach a height of two hundred feet with this machine before the fuel in the lines is exhausted.

Obviously, all machines must eventually be designed so that the throttles cannot be opened, or the switches moved, until the petrol has been turned on. Otherwise this unfortunate and unnecessary type of accident will recur at regular intervals.

Selling the Tipsy

THE concessionaires over the northern counties for the Tipsy monoplane, described and tested in *Flight* of May 28 and June 11 respectively, are Ryders' Motors, of Aintree Road, Bootle, Liverpool, 20. A demonstration machine will shortly be available in that part of the world.

Ira Eaker Errs

This Flying Game, by Brigadier General H. H. Arnold and Major Ira Eaker. (Funk and Wagnalls Company, London, price 12s. 6d.)

TWO of America's most distinguished military airmen have collaborated in the production of this book, which covers, in a broad, sweeping manner the intricacies of the modern aeronautical world. Their work is marred by ridiculous errors which will quickly manifest themselves to the English reader.

It tells, by way of example, how "Lieutenant" Boothman, of the "Royal Flying Corps," set up the "land-plane" speed record, and on the very next page of Stainforth's 408.8 m.p.h. in 1931, "flying his country's Gordon Bennett winner of that year." To crown it, on the following page we learn of how Agello ("the last of the Bullet Brigade left alive") pushed the mark up to 423 m.p.h. "while capturing the Schneider Cup from England."

The book will suit those who want the story of military and civil aeronautics, particularly as practised in America, told in the floral journalese of that country with no apparent concern for accuracy of detail.

An Airwork Appointment

THE increased number of commercial aircraft passing through the Heston workshops for overhaul or repair has made it advisable to make special provision for the interests of private aeroplane owners. Airwork has accordingly appointed Mr. H. Addinell to attend personally to all matters connected with the servicing of privately owned aircraft.

TALKING IT OVER: The recent announcement of a working arrangement between Phillips and Powis Aircraft Ltd., and Rolls - Royce Ltd., lends interest to this photograph of a group at Reading last week. From left to right are Mr. Hives, Mr. Ellor and Lt. Col. Darby of R.R. and Mr. C. Powis and Mr. F. G. Miles of P. and P. The other "personalities" are a Miles Whitney Straight and a Bentley.

THE ROYAL AIR FORCE

SERVICE NOTES AND NEWS — AIR MINISTRY ANNOUNCEMENTS

A HENDON DÉBUTANT: The Armstrong Whitworth Whitley heavy bomber is likely to make its first public appearance at the R.A.F. Display on June 27. Its engines are two 790/880 Tiger IXs.

ENTRANCE TO R.A.F. STAFF COLLEGE

The following officers have been selected for the 15th course at the R.A.F. Staff College, beginning January, 1937:—Sqn. Ldr. R. L. Ragg, A.F.C., Flt. Lts. J. R. Adams, A.F.C., R. L. R. Atcherley, G. R. Beamish, F. G. Cator, J. W. Colquhoun, H. I. Cozens, L. Dalton-Morris, I. J. Fitch, F. J. Fressanges, C. R. Hancock, D.F.C., C. M. Heard, F. S. Hodder, W. T. Holmes, R. B. Jordan, F. M. V. May, D. Macfadyen, G. F. Macpherson, T. N. McEvoy, A. H. Montgomery, M.B.E., J. Norwood, M. D. Ommanney, W. A. Opie, W. F. Pharazyn, T. G. Pike, A. C. H. Sharp, J. E. R. Sowman (Stores Branch), W. G. S. Wood (Stores Branch), F/O. F. C. Read (Stores Branch).

Officers who qualified at the 1936 examination but have not been selected for the 1937 course will be considered for the 1938 course.

The names of officers nominated by the Dominions to attend the 15th course will be published at a later date.

CADRE AND A.A.F. SQUADRONS

Auxiliary Air Force squadrons will carry out annual training during 1936 as follows:—

No. 501 (City of Bristol) (B) Squadron, August 1 to 15, Donibristle.
No. 502 (Ulster) (B) Squadron, July 13 to 25, Manston.
No. 503 (County of Lincoln) (B) Squadron, July 12 to 26, Hawkinge.
No. 504 (County of Nottingham) (B) Squadron, July 25 to August 8, Hawkinge.
No. 600 (City of London) (F) Squadron, August 8 to 22, Hawkinge.
No. 601 (County of London) (F) Squadron, August 2 to 16, Lympne.
No. 602 (City of Glasgow) (B) Squadron, July 17 to 31, Tangmere.
No. 603 (City of Edinburgh) (B) Squadron, July 12 to 26, Leuchars Armament Training Camp.
No. 604 (County of Middlesex) (F) Squadron, August 2 to 16, Tangmere.
No. 605 (County of Warwick) (B) Squadron, August 2 to 16, Aldergrove Armament Training Camp.
No. 607 (County of Durham) (B) Squadron, July 3 to 17, Tangmere.
No. 608 (N. Riding) (B) Squadron, August 16 to 30, Tangmere.

The annual training period for No. 500 (County of Kent) (B) Squadron will be notified later.

SHOOTING AT BISLEY

In the R.A.F. rifle shooting matches at Bisley the Brooke-Popham-Steel Cup for squadron teams of four was won by No. 607 (County of Durham) (Bomber) Squadron. Second place was gained by No. 13 (A.C.) Squadron. F/O. G. E. Watts was the best shot of the meeting.

FLYING ACCIDENT

The Air Ministry regrets to announce that A/C.1 Francis Allday and A/C.1 Allan Sanderson Bailey lost their lives as the result of a collision in the air which occurred at Sheikh Othman, Aden, on June 9. The pilots of the two aircraft were uninjured.

R.A.F. BENEVOLENT FUND

The usual meeting of the Grants Committee was held at Iddesleigh House on Thursday, June 4. Mr. W. S. Field was in the chair, and the other members present were:—Mrs. L. M. K. Pratt Barlow, O.B.E., Air Comdre. B. C. H. Drew, C.M.G., C.B.E., and Group Capt. C. H. K. Edmonds, D.S.O., O.B.E. The committee made grants to the amount of £780 12s. 1d. The next meeting was fixed for June 15.

CAREERS OF AIRMAN CLERKS

The review of the requirements of the service in airmen has now been completed as regards airmen of group IV, and the decisions reached are outlined below.

Recruitment.—There will be no change in the system under which clerks are obtained partly by entering apprentices for training as clerks and partly by entering adult recruits with clerical experience. The majority of the requirements will in future be met from the apprentice entry, and it is intended that most of the accounting posts, and more than half the general duties posts, shall be filled by ex-apprentices.

Organisation.—The sub-trades of clerk, pay accounting, and clerk, store accounting, are being amalgamated and provision is made therein for the mustering or remustering as clerks, accounting, of certain airmen who are qualified in both sub-trades. Airmen whose remustering is not provided for in those orders will be remustered as clerks, accounting, on promotion to sergeant after passing the examination required, which includes tests of ability to supervise both sub-trades. Airmen who already hold the rank of sergeant or above are to be similarly remustered forthwith, provided they passed the Central Trade Test Board examination for confirmation as sergeant.

The sub-trades of clerk, general duties, and clerk, accounting, will in future be regarded as entirely distinct in all ranks, including that of warrant officer, the existing provision for interchangeability in warrant rank being cancelled. Warrant officers (administrative) will, therefore, be drawn only from clerks, general duties, and warrant officers (accountant) from clerks, accounting.

Career of Ex-apprentices.—(i) It will be the policy to provide for ex-apprentice clerks a career which approximates, both as regards promotion and re-engagement, to that announced for other apprentice entrants. Thus, while the actual flow of promotion must depend on the requirements of the service it is intended that, when certain abnormal conditions have passed away, all suitable leading aircraftmen will be promoted to corporal during the initial period of engagement and during the same period a majority of corporals will be promoted to sergeant: of the restricted number of men selected for re-engagement a majority will be promoted to flight sergeant in the earlier part of their re-engaged service and a substantial minority of flight sergeants will be promoted later to warrant officer.

(ii) Ex-apprentice clerks who do not desire or whom it is not possible to re-engage to complete time for pension will be given the opportunity, on completing their twelve years' man's service, to enlist in the reserve for four years and to receive the special gratuity of £100 under the same conditions as apply to ex-aircraft apprentices.

Career of Direct-entry Clerks.—Policy will be directed towards the provision, for clerks entered as adult recruits, of a career similar to that announced for non-apprentice tradesmen in groups I-III. Subject to the requirements of the service it may, therefore, be anticipated that, when normal conditions are reached, a majority of re-engaged men will be promoted to sergeant on the completion of approximately twelve years' service and that a considerable minority will be promoted to flight sergeant and to warrant rank.

ROYAL AIR FORCE GAZETTE

London Gazette, June 9, 1936

General Duties Branch

Lt. S. S. Fielden, Royal Artillery, is granted a temporary commission as Flying Officer on being seconded for duty with the Royal Air Force (May 24).

The following Acting Pilot Officers on probation are confirmed in rank and graded as Pilot Officers with effect from the dates stated:—H. A. R. Holford (February 29); M. S. Bocquet, N. A. N. Bray, G. A. Corder, L. E. Cryer, C. S. Darwood, T. M. Evans, A. D. C. Fair, T. W. C. Fazan, R. R. Holder, C. G. Isacke, J. A. Kent, O. R. C. Moseley, J. B. Russell, A. M. Smith, E. H. T. Thwaites, A. J. Trumble, J. Vivian, R. Williams (March 15); M. R. Baillon, P. H. Bragg, G. A. L. Cheatle, J. J. E. Coats, R. B. Cox, P. J. G. Davies, G. H. J. Feeny, G. H. N. Gibson, J. Greenhalgh, D. A. Hamilton, R. B. Harvey, J. V. Hoggarth, C. J. K. Hutchins, E. L. Hyde, A. G. T. James, E. H. Jones, J. A. C. Karran, L. J. Kiggell, L. A. G. S. Lewer, R. C. Love, F. R. McAllister, A. S. McTurk, C. A. Masterman, W. E. Mulford, R. J. Ommanney, C. L. Page, M. V. Peters-Smith, A. C. Rabagliati, J. Rankin, B. D. Sellick, J. G. Spencer, R. D. Stubbs (April 16).

Pilot Officer on probation R. H. S. King is confirmed in rank (April 16).

The following Acting Pilot Officers on probation are graded as Pilot Officers on probation with effect from the dates stated:—A. W. Fletcher (February 29); G. I. L. Corder, J. W. S. Forbes, K. E. Kennedy (March 4); D. Nolan-Neylan (March 15).

F/O. R. Sorel-Cameron is promoted to the rank of Flight Lieutenant with effect from June 9.

The following Pilot Officers are promoted to the rank of Flying Officer with effect from the dates stated:—R. V. L. Pattison, D. G. H. Spencer, A. M. A. Birch (April 22); R. G. Musson, R. G. Slade (May 7).

Wing Cdr. P. C. Sherren, M.C., is placed on the retired list on account of ill-health (June 1); P/O. J. A. Tinne is transferred to the reserve, Class A (May 21).

The short service commissions of the following Acting Pilot Officers on probation are terminated on cessation of duty (May 28):—P. J. F. Donnelly, D. A. Newell.

Medical Branch

Flt. Lt. P. H. Perkins, M.R.C.S., L.R.C.P., is promoted to the rank of Squadron Leader (June 1).

ROYAL AIR FORCE RESERVE

Reserve of Air Force Officers

General Duties Branch

The following Flying Officers relinquish their commissions on completion of service and are permitted to retain their rank:—F. Elliam (May 1); J. S. Arthur, M.C. (May 8); C. H. Graham (May 15).

AUXILIARY AIR FORCE

General Duties Branch

No. 604 (COUNTY OF MIDDLESEX) (FIGHTER) SQUADRON.—The following are granted commissions as Pilot Officers:—J. Cunningham (May 7); J. B. Selway (May 5)

No. 607 (COUNTY OF DURHAM) (BOMBER) SQUADRON.—P/O. D. Redington is promoted to the rank of Flying Officer (May 19).

No. 609 (WEST RIDING) (BOMBER) SQUADRON.—H. E. H. Pelham-Clinton-Hope, Earl of Lincoln, is granted a commission as Flying Officer (April 24).

No. 611 (WEST LANCASHIRE) (BOMBER) SQUADRON.—W. J. Leather is granted a commission as Pilot Officer (May 14).

Stores Branch

A. C. Bolton (Flight Lieutenant R.A.F., retired) is granted a commission as Flight Lieutenant (April 14).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified:—

General Duties Branch

Air Commodore.—B. E. Sutton, D.S.O., O.B.E., M.C., to Headquarters, No. 2 (Bomber) Group, Abingdon; on appointment as Air Officer Commanding, 1.6.36.

Group Captain.—R. M. Field, to R.A.F. Station, Boscombe Down; to command, 29.5.36.

Squadron Leaders.—G. S. N. Johnston, to Headquarters, Air Defence of Great Britain, Uxbridge; for Air Staff duties, 1.5.36. G. Martyn, to D.O.I., Dept. of C.A.S., Air Ministry, 27.5.36. G. Y. Tyrrell, M.C., to No. 502 (Ulster) (B) Squadron, Aldergrove. To command, 26.5.36.

Squadron Leader.—S. L. G. Pope, D.F.C., A.F.C., to School of Naval Co-operation, Lee-on-the-Solent. For duty as Adjutant, 27.5.36.

Flight Lieutenants.—C. Walter, to Royal Air Force College, Cranwell, 3.6.36. R. A. Sprague, to Superintendent of the Reserve, Hendon, 2.6.36. H. N. G. Ramsbottom-Isherwood, to Aeroplane and Armament Experimental Establishment, Martlesham Heath, 30.5.36. M. Hare, to Aeroplane and Armament Experimental Establishment, Martlesham Heath, 2.6.36. D. W. F. Bonham-Carter, to Aeroplane and Armament Experimental Establishment, Martlesham Heath, 20.5.36. G. R. M. Clifford, to No. 48 (G.R.) Squadron, Manston, 20.5.36. W. E. Rankin, to School of Air Navigation, Manston, 20.5.36.

Flying Officers.—The undermentioned are posted to No. 1 Flying Training School, Leuchars, on appointment to temporary commissions on being seconded to the Royal Air Force from the Army with effect from 18.5.36:—D. C. Curme, J. K. M. Drysdale, G. P. L. Weston, and J. F. Maffett. R. G. R. Buckley, to Electrical and Wireless School, Cranwell, 24.5.36. R. J. Gosnell, to No. 31 (Army Co-operation) Squadron, Karachi, India, 26.4.36. A. R. G. Bax, to No. 18 (B) Squadron, Bircham Newton, 4.6.36. C. H. D. Wardrop, to No. 603 (City of Edinburgh) (B) Squadron, 21.5.36. S. T. Misselbrook, to No. 48 (G.R.) Squadron, Manston, 20.5.36.

Pilot Officers.—H. C. Sawyer, to Electrical and Wireless School, Cranwell, 30.5.36 L. C. Bicknell, to No. 65 (F) Squadron, Hornchurch, 30.5.36. H. L. Dawson, to No. 15 (B) Squadron, Abingdon, 30.5.36. F. M. Smith, to No. 18 (B) Squadron, Bircham Newton, 30.5.36.

The undermentioned are posted to the Units shown on appointment to permanent commissions as Pilot Officers, on probation, 21.5.36:—W. T. Dennis, to No. 9 (B) Squadron, Aldergrove. J. E. Dutton, to No. 215 (B) Squadron, Upper Heyford. R. J. Kemsley, to School of Naval Co-operation, Lee-on-the-Solent. S. Lugg, to No. 7, Flying Training School, Peterborough. J. McLaughlin, to R.A.F. Station, Gosport. R. S. Mills, to No. 1 (F) Squadron, Tangmere. A. Ovenden, to No. 9 (B) Squadron, Aldergrove. J. G. Priest, to No. 11 Flying Training School, Wittering. E. N. Rooms, A.F.M., to No. 97 (B) Squadron, Boscombe Down. F. L. Savers, to No. 1 Flying Training School, Leuchars. C. E. Sims, to No. 3 Flying Training School, Grantham. C. E. Slee, to No. 7 (B) Squadron, Worthy Down. R. W. Stewart, to No. 25 (F) Squadron, Hawkinge. G. E. Harrison, to No. 98 (B) Squadron, Abingdon, 4.6.36. P. S. Hutchinson, to Station Flight, Duxford, 18.5.36. T. G. W. Appleby, to No. 214 (B) Squadron, Andover, 1.6.36. J. N. Glover, to No. 215 (B) Squadron, Upper Heyford, 1.6.36. S. G. F. Curry, to No. 10 (B) Squadron, Boscombe Down, 4.6.36. G. D. Garvin, to No. 215 (B) Squadron, Upper Heyford, 4.6.36. C. F. King, to No. 97 (B) Squadron, Boscombe Down, 4.6.36. C. H. Mitchell, to No. 9 (B) Squadron, Aldergrove, 4.6.36. K. B. F. Smith, to No. 58 (B) Squadron, Upper Heyford, 25.5.36.

Acting Pilot Officer.—F. D. D. Jones, to No. 2 Flying Training School, Digby, 22.5.36.

The undermentioned are posted to No. 8 Flying Training School, Montrose, with effect from May 16, 1936:—G. V. Aylott, L. M. Beavis, J. L. Beck, T. A. Bunting, P. Corbishley, S. F. Coutts-Wood, C. A. R. Crews, C. D. Fox, G. E. French, K. M. Gillies, I. R. Gleed, E. A. Hunt, B. O. Huxtable, P. G. Jameson, D. I. Jobson, G. C. O. Key, T. W. Lamb, W. M. Lupton, A. N. Macfarlane, R. A. G. Morgan, J. F. Newman, G. K. Peacock, R. D. E. Pitcairn, H. F. Plank, L. G. Schwan, W. T. Scott, N. J. Starr, J. F. Sutton, R. N. Wall, and G. S. Woodward. W. R. Gardiner, to No. 8 Flying Training School, Montrose, 21.5.36.

Stores Branch

Flight Lieutenant.—M. J. Scott, to D. of E., Dept. of A.M.S.O., Air Ministry, 2.6.36.

Flying Officers.—H. H. Hilliar, to No. 2 (Indian Wing) Station, Risalpur, India, 17.4.36. G. R. Thwaite, to Aircraft Park, Lahore, India, 9.4.36.

Accountant Branch

Squadron Leader.—W. W. Deane, to No. 10 Flying Training School, Tern Hill; for Accountant duties, 3.6.36.

Flight Lieutenant.—V. Matveieff, to No. 5 Flying Training School, Scaland, 1.6.36.

Medical Branch

Wing Commander.—G. H. H. Maxwell, to R.A.F. Station, Manston; for duty as Medical Officer, 30.5.36.

Squadron Leader.—F. B. C. L. B. Crawford, to Home Aircraft Depot, Henlow, 1.6.36.

Flight Lieutenant.—C. Crowley, to R.A.F. Depot, Uxbridge, 2.6.36.

Flying Officers.—R. C. O'Grady, to Medical Training Depot, Halton, on appointment to a short service commission with effect from 11.5.36. E. W. R. Fairley, to Medical Training Depot, Halton, on appointment to a short service commission with effect from 15.5.36.

Dental Branch

Flying Officer.—S. Hill, to Home Aircraft Depot, Henlow, 3.6.36.

Chaplains Branch

Revd. L. Wright, to Headquarters, R.A.F., Cranwell; on appointment to a short service commission with effect from 14.5.36.

THE THOROUGH SURVEYOR

Some Discoveries which Reveal a Sinister Connection Between Rates-of-Climb and Climb-of-Rates

IF you see a D.H. Dragon, Short Scion or Jubilee Monospar flying gently in a straight line 9,000 ft. over your roof don't just casually remark to the wife, "It's an airliner." Remember, instead, that it may well be public enemy number one and responsible for some forthcoming increase in your rateable value. To add insult to injury, you have to pay for the process by which your rates are assessed.

In the old days one had more warning. A couple of soldiers came along armed with chains (or, mayhap, rods, poles or perches), a telescopic high-water level and a funny little telescope, with which they kept peeping at one another. They walked round the house, trod on the geranium that aunt Fanny gave you, and departed. The eventual outcome was a large-scale map and the extension to the dining room became known to the rating authorities. Now all is different. The aforesaid aeroplane passes over, a shutter clicks, a photograph is taken and the job is done. All over the country, authorities, local and otherwise, are using air-made maps.

The Modern Method

Recently we paid a visit to Aerofilms, Ltd., at Bush House, London, and were astounded at the variety of aerial mapping work being done. With the enormous growth of urban districts it is impossible for the existing maps to be revised speedily enough by ground methods, so the Ordnance Survey people allocate areas to be photographed. Four hundred square miles were done in 1935 and 490 square miles are to be done this year. In addition, work is being carried out for ten borough and urban district councils independently, while to illustrate the variety of subjects actually in hand at the moment, there is an overlap of the River Medway to a scale of 1/360th for the Catchment Board and an air map of 4,000 square miles of Iran for the Anglo-Iranian Oil Co., Ltd.

Like most useful things, the process is comparatively simple. For ordnance map revision the machine flies on a series of parallel lines at 9,000 ft. and pictures are taken every few seconds, the exact period being based on the speeds of the wind and the aeroplane. A forward overlap of about 60 per cent. is obtained, and the parallel lines are so arranged as to give 15 to 30 per cent. overlap in the other dimension. The Williamson Eagle IV camera, used automatically, attends to the winding of the film (which is 165ft. long and provides for 200 exposures 9in. x 7in. each), the setting of the shutter and the taking of the photographs at predetermined intervals. A red light, and finally a green one, shows on the pilot's dashboard to warn him that the camera is about to expose, and he must then ensure the machine is flying on a perfectly level keel.

Potted Persia: Sorting some of the 30,000 photographs required for the Anglo-Iranian Company's air map. (*Flight* photograph).

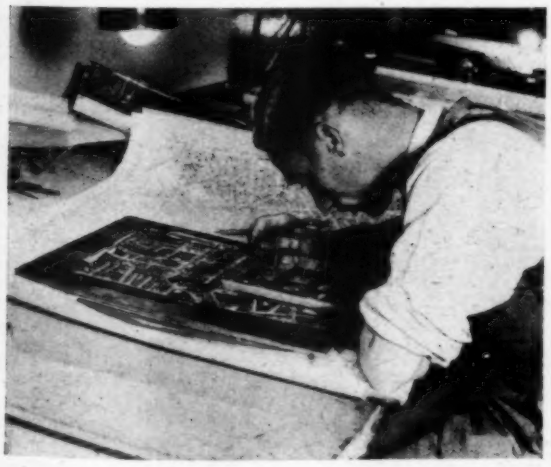
After the films are developed, contact prints are made to check whether there are any gaps in the overlap for, despite the generous overlap allowed, occasional small gaps do occur. The next process is to make a set of enlargements twice the linear dimension, which brings the scale to that of the standard ordnance survey of 1/2,500th. These are made on an enlarger, which has a tilting easel so that any slight deviation from the absolute perpendicular of the camera can be corrected.

Infinite Pains

The remainder of the process is mostly one of taking infinite pains. Each photograph and its neighbour is inspected through a stereoscope, which throws all the ground objects into strong relief, and the details seen are then traced on to the existing maps. Even such small details as garden sheds are put in, so don't hope to get away with anything as large as a garage. Although, on the face of it, these surveys are expensive, most of them have proved profitable by reason of the increased rates obtained by the authorities—which explains how insult is added to injury.

At first sight it would appear almost impossible to work photographically at 9,000ft. in England, but in an average year 150 hours are available between April and September. There are exceptions, of course. To get an air map of the district covered by the underground railways of London, two years elapsed owing to the difficulties encountered with bad weather, smoke and haze.

J. Y.



Willesden canvas: A draughtsman going stereoscopically from house to house to revise the map of Willesden seen under the photographs. (*Flight* photograph.)

A fitting task: Setting up the 1/360th scale map of the River Medway for the Catchment Board. (*Flight* photograph.)

TAIL-UP 3-POINTERS!

A New Three-wheel Undercarriage with Many Advantages

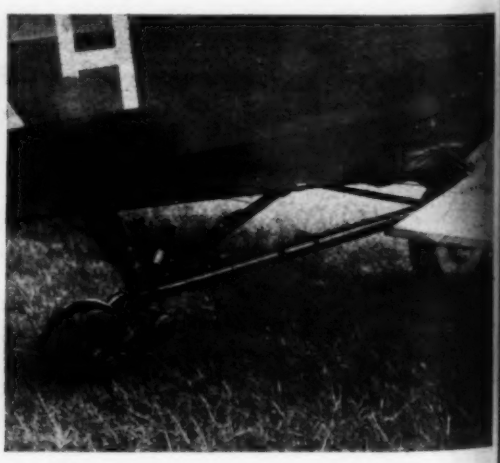
The B.L.G. undercarriage in action on an Avro Avian. Above is seen a take-off, showing the front wheels off the ground. On the left is a landing. The pilot was Mr. R. L. Palmer, of the Hanworth School, who has done the testing and is doing the demonstrations of the undercarriage. The elevator is in the neutral position in both cases. (*Flight* photographs.)

OFTEN the obvious escapes detection. In the earliest days of flying, aeroplanes used to be provided with all manner of skids. Some had pairs of them, some a single skid, but nearly all had skids of one sort or another. The Wright Brothers started by fitting skids only, the wheels coming afterwards. For the most part the object of the skids fitted to early aeroplanes was to prevent "nosing over." In recent times attempts are being made to introduce the modern equivalent in the form of a third wheel. As the idea is to prevent the machine from turning over, the obvious thing is to place the third wheel behind the main wheels has not, appargood, or even better, results could be obtained by placing the third wheel behind the main wheels has not, apparently, occurred to anyone until quite recently.

Work has been going on quietly at Hanworth for some months in producing and developing a three-wheeled type of undercarriage which does a great deal more than preventing an aeroplane from nosing over. Owing its conception to Mr. Eugster and Mr. Cowey (of speedometer fame), the experimental undercarriage has been manufactured by Rollasons, and has been fitted to an old Avro Avian. The whole equipment is experimental, and the components are made a good deal larger and heavier than they would need to be if originally incorporated in the design.

In its general conception the new undercarriage is based upon the fact that what causes an aeroplane to "balloon" off the ground again after touching down rather violently is not so much the mechanical rebound as the aerodynamic forces in play afterwards. A "harsh" undercarriage may cause it to bounce a little, but it will be a purely mechanical instead of an aerodynamic bounce. The rear wheel of the new undercarriage performs the function of preventing this increase of incidence.

It is conceivable that with the front wheels in the usual position a "glide-landing" with the nose down might result in the machine turning over. Also, landing with the wheels locked, or the too-sudden application of the brakes,



The experimental model of the B.L.G. undercarriage on the Avian. On the left are seen the three wheels, with the rear strut extended. On the right, the rear strut is telescoped. Note the long stroke. The rear strut operates an over-riding device which releases the front wheel brakes as soon as the rear wheel leaves the ground. (*Flight* photographs.)

might have similar results. To avoid this, the front wheels are placed about one foot farther forward than in the standard machine.

It is rather surprising, when one looks into the matter a little closely, how many desirable things become possible when the rear wheel is fitted. One of them is this forward placing of the front wheels. Without the rear wheel this would probably not be feasible, as it might be impossible to get the tail up during the early stages of the take-off; at any rate, the run to take-off would be greatly increased. With the rear wheel holding the tail up, there is no objection to placing the front wheels farther forward; or, rather, the only objection is that the machine may have a slight tendency to swing, due to the wheels being so far ahead of the centre of gravity. Another advantage of the rear wheel is that if all wheels are made retractable, as they probably would be when an aeroplane was designed originally to take this type of undercarriage, it becomes possible to provide a very long stroke, so that the undercarriage is capable of absorbing a very considerable shock. This should result in making glide landings and stall landings equally possible on fast and heavily loaded aeroplanes.

Brake Accommodation

On the Avro Avian used for the experimental test work the main undercarriage has been redesigned in order to make it possible to use Palmer wheels with Palmer brakes. In the main, the changes consist in adding an extra strut to the radius rod. The rear wheel is a Dunlop tail wheel carried on a fork which is, in turn, supported on a long-stroke telescopic strut. This strut has its upper end anchored to the fuselage members, and its lower end is positioned by two radius rods arranged in a vee.

The shock-absorbing front struts are of usual type, with compressed air for taking the weight of the machine and an oil damper with a leak-hole for checking bouncing. The rear strut is damped in both directions, leak-holes ensuring that the piston can travel slowly without much resistance, but opposing a sudden application of load.

When flying the experimental machine, some little mental courage is necessary to leave it in a firm glide right into the ground, but, after the initial attempt, this method of landing loses all its terrors. The undercarriage certainly does everything that is claimed for it, and the only limit to the speed at which the machine may be forced into the ground is that very naturally provided by undercarriage travel and structural strength.

After a touch-down at 65 m.p.h. the effect is similar to that in a particularly well-"sprung" machine in which a phenomenally expert instructor is preventing the resultant balloon by holding the tail up. In fact, it is possible to obtain a very mild bounce by the simple expedient of pulling the control hard back at the moment of touching, and so forcing down the tail to a minor degree. The effect then is little worse than that after performing a three-pointer on an unseen ridge.

The least effective landing, curiously enough, is the traditionally "good" landing, when the pilot leg touches first and causes the nose to fall immediately afterwards.

During the take-off the tail is initially lifted in the ordinary way, and the machine is then allowed to fly itself off at an indicated speed of 60 m.p.h. If the run appears to be prolonging itself, a gentle backward movement will hoist the machine into the air, and it is possible, of course, to depress the tail at an earlier stage if a quick take-off is required. For the novice the pilot leg will normally prevent a departure from the ground until there is more than ample control in all axes.

When using the brakes as it is possible to use them, immediately after making contact, the most unusually short landings can be made over high obstacles. During our test the machine was being brought over the Hanworth houses at a safe height, yet the run had terminated in something like two hundred yards from the boundary which accommodates these houses. In an "Outlook" paragraph on page 641 and in the private flying comments on page 654 some of the more important possibilities of this development are outlined.

A syndicate has been formed under the title, British Landing Gears, Ltd., to develop the undercarriage and place it on the market. The address is 19, Coleman Street, London, E.C.

CONVOY: A flight of Vickers Valentia bomber-transports (Pegasus) conveying urgent supplies of machine guns, ammunition and stores during the Palestine troubles. By train the 300-mile journey takes fourteen hours. The Valentias do it in three.

THE INDUSTRY

GROUND EXPANSION: The first consignment of a new fleet of light tenders ordered for the R.A.F. from the Singer Company of Coventry—which firm, incidentally, is one of those co-operating in the emergency output scheme for aero engines and components.

"B.A.C." to "Kronfeld"

AS mentioned last week under the Company Notices on p. 638, B.A.C. (1935), Ltd., have changed their name to Kronfeld, Ltd. Mr. Kronfeld emphasises that this does not indicate any change in the company's constitution, but has been made simply to avoid confusion with other concerns of somewhat similar name.

I.O.M. Air Race Echo

THE winner of the recent London—I.O.M. race, Mr. Alex Henshaw, used Lodge plugs in his Leopard Moth (Gipsy Major). Plugs of the same make were also used by Mr. R. F. Hall (Hillson Praga), F/O. A. E. Clouston (Aeronca) and Mr. L. Lipton (Gipsy III Moth), who finished first, second and third respectively in the Manx Air Derby.

Electrical Expertness

AFTER twenty-one years as head of the technical department of Rotax Ltd., Mr. E. Hill, M.I.P.E., has established a car electrical service depot at Wembley. Mr. Hill, who has represented the electrical side of the motor industry on a number of S.M.M. and T. and B.S.I. Standards Committees, is open to doing consultation work on car and aircraft lighting, starting and ignition.

H.P. Progress

A VERY satisfactory state of affairs is shown by the Handley Page report for 1935 issued last week, prior to to-morrow's ordinary general meeting. Whereas the net profits in 1934 were £44,590, they rose to £77,893 last year. The payment to preference shareholders is raised from 15 per cent. to 20 per cent., while a sum of £19,914 (against £9,987) is distributed on the £7,500 of ordinary capital.

Instruments—How and Why

AN extremely interesting catalogue of aircraft instruments has been issued by Negretti and Zambra, of 38, Holborn Viaduct, London, E.C.1. Each instrument is illustrated and clearly described and—this is a particularly useful point—sectional drawings explain the operation of each. The instruments covered in the catalogue are fuel and oil pressure gauges, boost gauges, radiator, air and oil thermometers, and precision altimeters.

Bristol Progress

THE twenty-sixth ordinary general meeting of the Bristol Aeroplane Co., Ltd., is to be held next Tuesday to receive the directors' report and statement of accounts. The report indicates a very satisfactory state of affairs. Profit, struck after providing for depreciation, but subject to income tax, amounted for 1935 to £302,225; this compares with £217,102 for 1934, as appearing in the statement issued when the shares were placed on the market, and, after allowing for the Preference dividend, is equivalent to 45 per cent., less tax, on the Ordinary capital. By paying 22½ per cent. for the year the board is able to place £100,000 to reserve and to carry forward a balance of £40,233.

NEW COMPANIES

In the notes below, for reasons of space, the "objects" of new companies are usually somewhat abbreviated.

WESTERN AIRCRAFT SALES, LTD. Private company, registered June 8. Capital, £1,000 in £1 shares. Objects: to carry on the business of manufacturers of and dealers in aeroplanes, airships, etc. The permanent directors are: Robert White, "Crahmond," Hampton Park, Hereford (director of H. B. Rogers Motors, Ltd.); Edward R. Exell, Greenacres, Bobblestock, Hereford; Wm. T. Thorne, 16, The Butts, Worcester (director of Thorne's (Worcester), Ltd.).

SHORT AND HARLAND LIMITED was registered in Belfast as a private company on June 2, with a nominal capital of £450,000 in £1 shares. The objects are to carry on the business of aeronautical engineers, manufacturers and repairers of seaplanes and aircraft of all kinds. The directors are: Hugh O. Short, Oak Tree Court, Templewood Gardens, Hampstead, London, N.W.3, engineer and director; Henry P. Harland, Aldenham, nr. Watford, director; Frederick I. Rebbeck, Sandown House, Neills Hill, Knock, Belfast; Arthur Gouge, Upon, King's Avenue, Rochester, Kent; James H. Wood, 12, Watts Avenue, Rochester, Kent. The registered office is at 11, Wellington Place, Belfast.

INCREASES OF CAPITAL

CARDEN AERO ENGINES, LTD. The nominal capital has been increased by the addition of £500 in £1 ordinary shares beyond the registered capital of £1,000.

SHORT BROTHERS (ROCHESTER AND BEDFORD), LTD. The nominal capital has been increased by the addition of £100,000 beyond the registered capital of £150,000. The additional capital is divided into 400,000 ordinary shares of 5s.*

HAWKER SIDDELEY AIRCRAFT CO., LTD. The nominal capital has been increased by the addition of £2,000,000 beyond the registered capital of £2,000,000. The additional capital is divided into 1,000,000 5 per cent. cumulative preference shares of £1 each and 4,000,000 ordinary shares of 5s. each.*

* As announced in *Flight* last week.

AERONAUTICAL PATENT SPECIFICATIONS

(The numbers in brackets are those under which the Specifications will be printed and abridged, etc.).

(*Published June* 18, 1936).

29839. FAIREY AVIATION CO., LTD., and ORDIDGE, F. H.: Retractable undercarriages for aircraft (447,610).
33499. RICE, R. M. A.: Variable-pitch airscrews (447,424).
33901. SARGENT, J. H.: Electrically heated steering wheel for motor vehicles and aircraft (447,619).
7012. ARMSTRONG WHITWORTH AIRCRAFT, LTD., Sir W. G., and MURRAY, C. V.: Movable gun supports, particularly for aircraft (447,439).
13011. SOC. D'INVENTIONS AERONAUTIQUES ET MECANIQUES S.I.A.M.: Retractable landing gear for aeroplanes (447,448).
14200. CABELLOS DE OROPESA, J. M. T.: Braking system for aeroplanes (447,573).
15630. BLACKBURN AEROPLANE & MOTOR CO., LTD., and BUMPUS, F. A.: Folding self-supporting cantilever wings for aircraft (447,577).
15822. SHORT BROS. (ROCHESTER & BEDFORD), LTD., and GOUGE, A.: Spars for aircraft wings (447,520).
20635. DORNIER METALLBAUTEN GES., and DORNIER, C.: Aircraft wings (447,688).
34685. ORIGINAL BRUGN TAXAMETER-U. KONTROLLAPPARATE GES.: Pressure speed-indicators for aircraft (447,667).

PUBLICATIONS RECEIVED

Aeronautical Research Committee Reports and Memoranda. No. 1668. Abstract: Stress-Calculation in Frameworks by the Method of "Systematic Relaxation of Constraints." I, II and III, by R. V. Southwell, price 2d. No. 1671: Flexural and Shear Deflections of Metal Spars, by I. J. Gerard and H. Boden, 9d. No. 1676: Abstract: Ice Formation in Carburettors, by W. C. Clothier, 2d. No. 1678: Laminar Boundary Layer on the Surface of a Sphere in a Uniform Stream, by S. Tomotika, 3s. No. 1680: Abstract: On the Synthesis and Analysis of Simply-Stiff Frameworks, by H. Roxbee Cox, 2d. No. 1669: Behaviour in Bending of Thin-Walled Tubes and Channels, by D. Williams, price 1s. No. 1670: Successive Approximation Method of Solving Continuous Beam Problem, by D. Williams, 1s. 3d. No. 1672: Loads and Bending Moments in Members of a Plane Braced Frame with Rigid Joints, by J. Morris, 2s. All from H.M. Stationery Office, Kingsway, London, W.C.2.

National Advisory Committee for Aeronautics Reports: No. 541: Aerodynamic Characteristics of Wings with Cambered External-Airfoil Flaps, including Lateral Control with a Full-Span Flap, by R. C. Platt, price 10 cents. No. 542: Potential Flow about Arbitrary Biplane Wing Sections, by I. E. Garrick, 10 cents. No. 547: Wind-Tunnel Interference with Particular Reference to Off-Center Positions of the Wing and to the Downwash at the Tail, by A. Silverstein and J. A. White, 10 cents. No. 549: Wind-Tunnel Investigation of the Aerodynamic Balancing of Upper-Surface Ailerons and Split Flaps, by C. J. Wenzinger, 10 cents. No. 550: Cooling Characteristics of a 2-Row Radial Engine, by O. W. Schey and V. G. Rollins, 10 cents. No. 551: Aircraft Compass Characteristics by J. B. Peterson and C. W. Smith, 10 cents. All from Superintendent of Documents, Washington, D.C., U.S.A.

Bibliography of Aeronautics, 1932. Price 50 cents, Superintendent of Documents, Washington, D.C., U.S.A.